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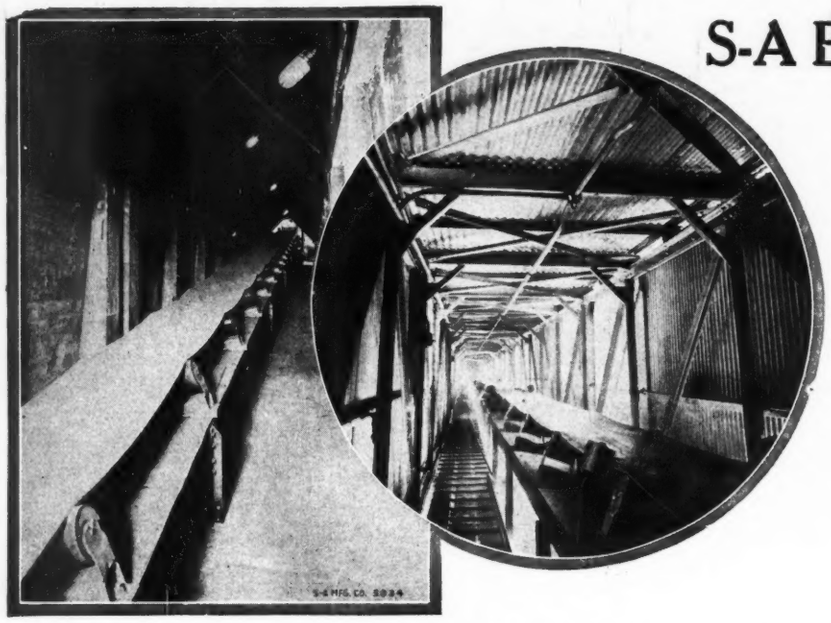

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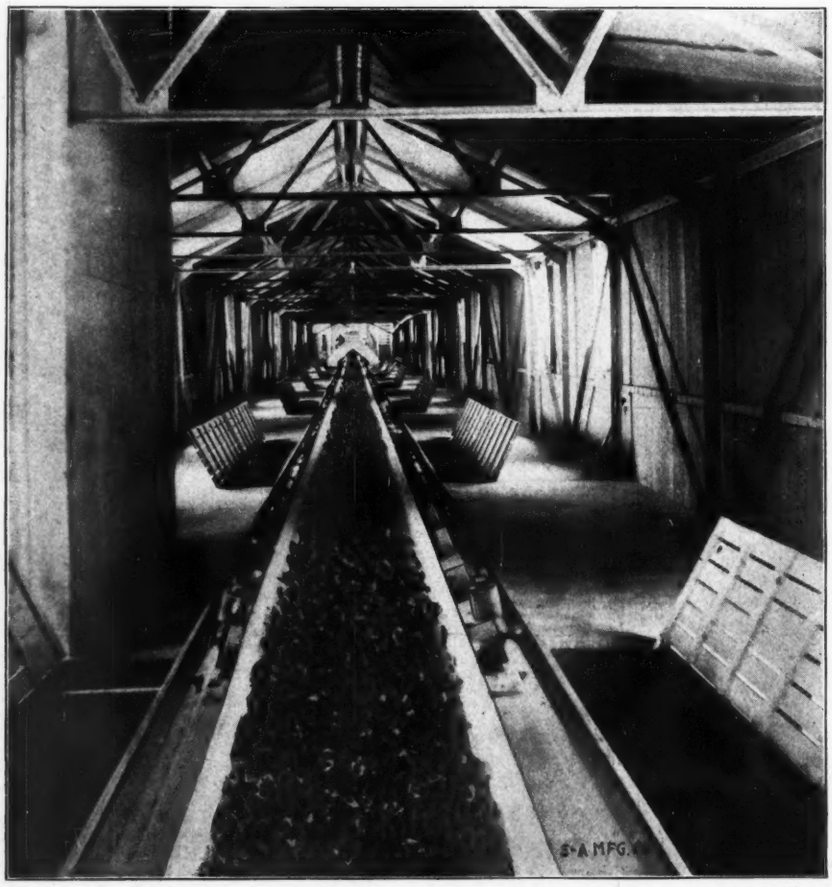

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The Co-ordination of the Mining Industry

*By J. E. SPURR**

MR. STOUGHTON, I understand, was to have spoken of the Federated American Engineering Societies. I am glad to add my vote to the effect that this is a big idea. It means an organization that will make it possible for the great and powerful engineer class of the country to act as a unity and therefore effectively, instead of as individuals or scattered and separate societies, and therefore ineffectively. By all means we should support this enthusiastically. It will make engineers better citizens.

But there is another classification in which we fall, besides being engineers. We are also miners—that is, representatives of the mining industry; and I venture to say that we are as much wrapped up, heart and soul, in our business as miners as we are in our profession as engineers. Looking at this phase we find that other engineers have less in common with us than many groups who are not engineers: the civil engineers, the architects, the highway and sanitary engineers, ordinarily concern us less closely than do the various groups other than engineers that form an integral part of the mining industry—namely, all those who mine, mill, smelt, transport, sell and manufacture the products of the earth. Engineering is our profession, mining is our business; we should organize for efficiency along both lines, and they lead us in different directions. Organization as engineers will allow us to use our training and skill for the greatest general service as citizens: organization as miners will promote the scientific progress of the great basic industry for which we are so largely responsible.

That organization of the industry has already gone far is shown by the record of this society. There are also other organizations devoted to various phases of our industry. We have a Mining and Metallurgical Society of America and an American Mining Congress. We have in Washington the Bureau of Mines and the Geological Survey; and in many of the states Mining Bureaus and Geological Surveys; in the legislative branch in Washington we have standing Committees on Mines and Mining. We have various other societies, such as the Zinc Institute and the newly organized Society of Economic Geologists; and we have a press devoted to the various phases of mining, from engineering to marketing. These elements of the government of the mining industry are like the thirteen colonies before they cast around for a plan whereby they might work as a unit. At present they often work at cross purposes, thus neutralizing their strength.

Yet those who conduct the industry have a heavy responsibility. This country has been more than all other nations endowed with great deposits of minerals. But the wise use of this power is an opportunity that will come to us just once in all eternity. As the stock phrase goes, "these ores are wasting assets." Our responsibility is to so manage the industry, with the aid of science, technical skill, knowledge of political economy, and of national and international relations, that the greatest benefit shall be obtained for the greatest number for the longest time.

The American Institute of Mining and Metallurgical Engineers specializes on the sciences of mining, metallurgical and geological engineering; the Mining and Metallurgical Society on the philosophical problems of mining; the American Mining Congress represents the mining interests, as the United States Chamber of Commerce does the manufacturing and trading interests, and has special direct methods for influencing direct governmental action in favor of mining. The Bureau of Mines specializes largely in safety work and metallurgical research; the Geological Survey on mining geology and the condition of the mining industry.

There is much overlapping, and there are many gaps. No attempt at co-ordination or the invention of a central co-ordinating device is described. Indeed, I believe that no two of these are co-ordinated. Is it not plain that we could progress further and faster if it could be done?

Granted that this is desirable, how shall we go about it? First, perhaps, for each group to find out what the other groups are doing. Has the Institute made any critical study of the Bureau of Mines or of the Mining Congress? I know that Mr. Callbreath, secretary of the Mining Congress, who is here, has appointed a committee to consider the co-ordination of the Institute and the Congress. How many of these organizations have made a critical study of the various branches of executive control of the mining industry in Washington or the mechanics of mining legislation by Congress, or the machinery which imposes tariffs on ores or their products? It is very much their business to do so.

Investigation, therefore, should come first. Then, in any event, co-ordination. Possibly a central council could be devised, a central mining council, scientifically chosen from the principal mining groups. If any special program agreed on by such a council should be supported by all the groups they should represent, the effect would be instant and powerful. It is not too much to say that the mining industry could thus be steered in the general direction of the greatest good to the greatest number for the longest time.

*This address, on account of lack of time, was read only by title at the banquet of the American Institute of Mining Engineers in Minneapolis on Aug. 26, 1920.

There is no use in imagining that any one organization like the Institute can swing the whole thing itself. It won't do it, and it can't do it. These other units are solid facts, like itself; and they have originated from fundamental needs, though ever so clumsily expressed. Mining engineers cannot afford to be narrow and clannish in this respect. It only reacts against them and diminishes their influence and authority.

Who controls the representation of the mining industry in Washington? In the executive branch, a lawyer; in the legislature, a conclave of farmers, lawyers, doctors, and what not. There is not a mining engineer on the Mines' Committee of either house; nor have they even a consulting engineer. You may imagine that the Bureau of Mines and the Geological Survey act in this capacity; but they do not. When the engineers of these bureaus appear before the committees, the committee has the same defensive and offensive attitude as it has toward the engineers with axes to grind for special interests. Its members believe that the Government bureaus are primarily interested in their own expansion, or, more specifically, in appropriations.

When the exigencies of the war showed the necessity of a close study and control of the mining industry no attempt was made to consult the industry itself, nor any one of its representative bodies. The control was left uncertain and remained split among half a dozen departments and special war boards. Necessity developed gradually a sort of central informal council out of this confusion, which became more definite toward the close of the war; but all this strenuous effort vanished with the armistice. In England they were not so quick to forget what they had learned as to the close relation between mining, political economy, and statecraft. In this country, at least, we must organize the relations of the mining industry and the Government largely from without the Government, for the inevitable bureaucratic organizations at Washington are not so free to speak or to work for reform and progress. Without outside stimulus they tend to become crystallized, set, and sometimes reactionary. But they are, I believe, in general, thankful for the outside stimulus.

The theme of my story is therefore: First a liberal attitude of one mining organization toward the others; second, an interested and thorough investigation by each of all the rest; third, co-ordination among all; and fourth, the suggestion of the achievement of this co-ordination through a central council.

Contracting and Leasing

CHANGED economic and labor conditions have brought into prominence both the contracting and leasing systems in mining operations. It is unnecessary to dilate upon the broad conditions affecting the mining industry, but high labor costs, diminishing tons per man per shift, have stirred mine managements to the point where they find it necessary to make a considerable amount of change in procedure. How to secure co-operation of mine workers in an enterprise is a critical problem, which affects the worker's interests as well as the industry as a whole. Contracting development work and leasing a block of ground in a mine have long been established practice, but there is a preponderance of the day's pay system. The bonus system has been thoroughly tried out, and it is doubtful whether it has adequately met the situation. At best it is a modification of the contract system.

The contract system has the advantage of putting a contract crew upon its mettle and establishing a definite responsibility for results. By making it complete—that is, making the contractors responsible for tools, supplies and power used—the company supplying only the necessary timber for support of workings and the general equipment for hoisting and haulage, the system has the advantage of establishing a definite business relationship between the company and the men on a basis distinct from day's pay and putting the details up to the men themselves. There is a real opportunity for a man to make better than day's pay. Skill and foresight will bring an added reward. The result to the company is a greater stabilization of operating conditions.

In leasing operations with payment on a sliding scale of royalties based on the recoverable value in the ore mined, the lessee has a stake in the enterprise. He is under the incentive to practice selective mining and to keep his own costs at a minimum. He occupies a higher place in the community in which he lives. The leasing system operates to produce cleaner mining and the lessee is alive to the following of leads and stringers of ore, with the result that sometimes blocks of ground abandoned as unprofitable under regular company operation become once more remunerative. A mine with well-developed ore bodies cannot lease its ground to advantage, but where ore bodies are numerous, irregular, and uncertain in size, as well as distributed over a wide area, the conditions are much more favorable for the leasing system. It is in mines of this kind that leasing is successful, though in mines of the developed type stoping on a contract basis presents distinct advantages.

We believe that under existing conditions both the contract and leasing systems warrant extensive use.

The Public and Mining Information

NOWADAYS one has but to enter a drug store to satisfy a desire for about everything from drugs to books and furnishings. Similarly with the press. For example, to be properly informed on the copper situation, perusal of the pages of a periodical ordinarily devoted to society news, fashions, art, and the theater seems to be in order. We were surprised to see in the September *Vanity Fair* an article covering the copper situation—for the layman (and by one?). It was easy reading, but that is about all that can be said for it. Excepting obviously erroneous statements, as "the well-known public . . . is completely deprived of knowledge as to developments in copper," which the Government and the technical press have been providing for years; "as a result, the price quoted by the great producers is to an exceptional extent nominal, and *occasional sales are made by smaller dealers below the market,*" and other conclusions of the writer requiring either qualification or elision, the article is commendable, if only as an attempt to clarify the situation for the benefit of the magazine's readers.

Oddly enough, comparatively little emphasis is placed by the popular press as a whole on the importance of the two great fundamental industries of the world—agriculture and mining. Considering humanity's su-

preme dependence upon these two activities, one would logically expect the conditions in farming or mining to be stressed more than they are by the general press. We have financial and class organs which make a specialty of covering particular fields, but, nevertheless, public ignorance concerning these two foundation piers to our commerce and prosperity needs much enlightenment.

We wish that knowledge of the copper industry's troubles were more generally disseminated, that information concerning our vanishing gold-mining industry were spread broadcast—by no means in a partizan sense—so that suggested remedies for the mining industries' ailments might be based on sound and fair premises through public understanding and co-operation; and that other phases of mining and metallurgy were better understood by the people at large.

Through its close contact with mines and minerals it is one of the functions of the technical mining press to inform the reading public of all phases of the industry. Necessarily, however, much of its published matter must be devoted to material that is intended for the specialist—the engineer—and hence will have only casual if any interest for other readers. Frequently articles are published, be they editorials, special contributions, or other matter, which are more general in appeal and purpose, but ordinarily they are only those embodying a broad economic discussion of some mining problem. But it is just these matters which the public should find of interest, and for which it should turn to the technical press for illumination. To keep pace with the expanding fund of human knowledge in all its branches is prima facie impossible, but to lose sight of the developments on the farms and in the mines means neglecting an inspection of the keystone of our prosperity.

"Salting"

IN A PREVIOUS editorial we touched upon the methods and ethics of dressing a mine for sale. The art of dressing progresses insensibly to that of salting. For the dresser may go further than putting his best foot foremost: he may so do this that it comes plainly under the category of sinful salting. An instance may be cited of a silver quartz vein, where the values were largely in streaks and spots of silver sulphides—argentite and tetrahedrite. This mine was sampled by many prominent engineers, who took every known precaution against salting. Their results varied widely, let us say from $16 to $23 average per ton; a final sampling gave, let us say, $12. The divergence was said to be due to the spotty nature of the ore, and the highest average was claimed to be as likely as the lowest. But the facts, as divulged by one on the inside, were that the moilers were miners from the vicinity, and that the owner of the mine rewarded them privately (in addition to their wages from the examining engineers) if they would simply hit the rich silver streaks a little harder and oftener in cutting the samples than they did the barren quartz. This was imperceptible to the watchful engineers who stood by; but if the mining costs were, say, $8, the difference between an average assay value of $12 and $16 doubled the net value of the mine.

The coarser and commoner tricks of salting are well known—as salting ore faces with a spray of gold or silver solution; or, more economically, salting samples, by inserting a syringe through canvas bags or in some other way—even through a keyhole a secondary enrichment may be accomplished. Salting of ore in place is expensive if the examining engineer takes large samples, and mill samples will exhaust the ammunition of a salter of this kind, and show a surprising discordance with the hand sampling. Therefore, salting the fluxes in the assayer's laboratory is a favorite trick, though easily detected if the assayer takes care to assay his materials continually.

We have seen samples, intended to promote investment or sale, that were salted in a cruder fashion. Dentist's gold, plugging the vesicles of a gray obsidian, caused a certain stampede in Nevada in the early days, and nearly procured for the enterprising prospectors the unloading of their claims; and a Colorado diamond-drill core of dioritic rock, with the softened feldspar neatly plugged with gold, caused an investment in the drilled ground by some noted mining engineers and financiers, and the plugger retired to the life of a country gentleman.

Placer ground is easily and, one might almost say, habitually salted. Fine placer gold mixed with tobacco and smoked as a cigarette eluded the vigilance of engineers who were examining placers in Santo Domingo. The natives washers had to smoke cigarettes, of course, and a little of the ash accidentally dropped in the pan separated some enterprising Americans from their roll. We have seen a very good "string of colors" in a gold pan which under the magnifying glass showed the shot-like form of assay buttons, instead of the familiar scales of placer gold.

There is no real safeguard against this dishonesty. A certain mine in the south showed excellent values on salting, but the shrewd purchaser insisted on a mill test, and a number of tons were run through. A little fine gold dropped by the owner at the head of the mill was recovered on the plates to the satisfaction of all; and the sale was made.

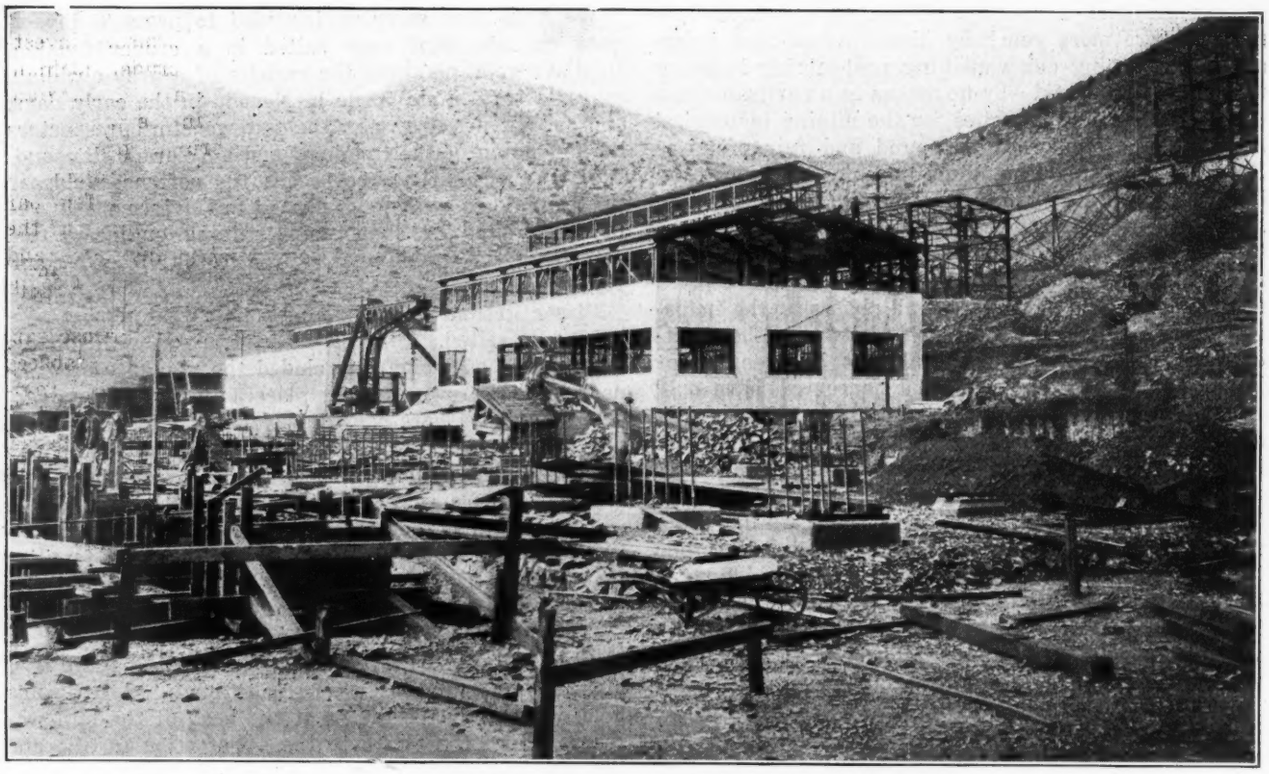
There are many engineers who will declare that they "cannot be salted." It is an unwise boast: any engineer can be salted. But a careful engineer can always discover it before it is too late. A system of duplicate and even triplicate samples, numbered variously by a secret system; occasional dead-head samples of known worthless material run in under the guise of ore samples; and a system of duplicate and even triplicate assays by independent and widely separated assayers, unknown to one another, form a precautionary armor which it is difficult for the swindler to pierce.

More Unemployment Problems

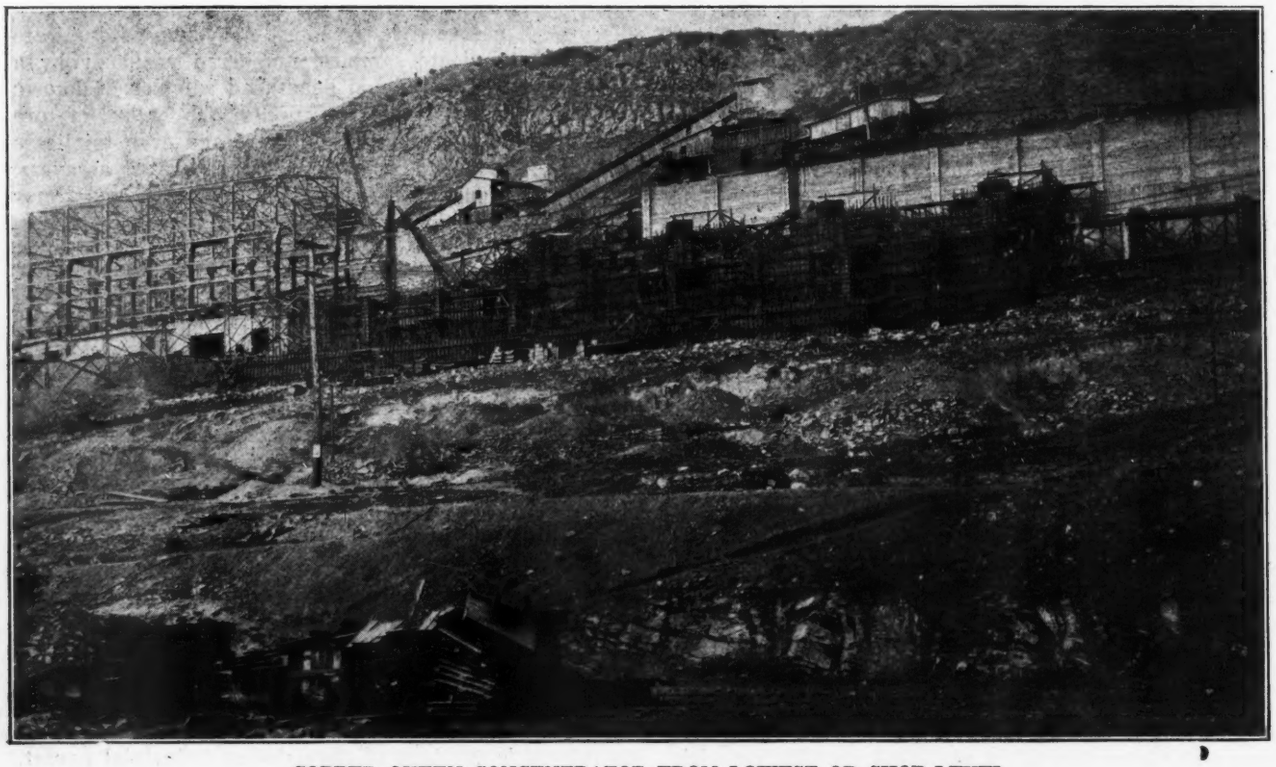
JUST when we are assured that the labor situation is becoming easier and that the cost of living is decreasing, another orgy of strikes has broken out in New York. First it was the baggage men, as a result of which it will now cost you 25c. more to have your trunk smashed in the metropolis. Now, the Brooklyn Rapid Transit is demoralized, and those who ride at all must do so in steel-caged cars, like the tigers in a circus parade. Moving-van men, painters, and plumbers have also quit work. From Pennsylvania comes word of 125,000 anthracite miners "on vacation." (A "vacation" is a strike not sanctioned by union officials.) British miners are likewise restless, and there are threats of a general walk-out. Striking metal workers in Rome, according to report, have seized several factories.

Unquestionably, the most pressing problem before executives is the cure of the existing industrial unrest.

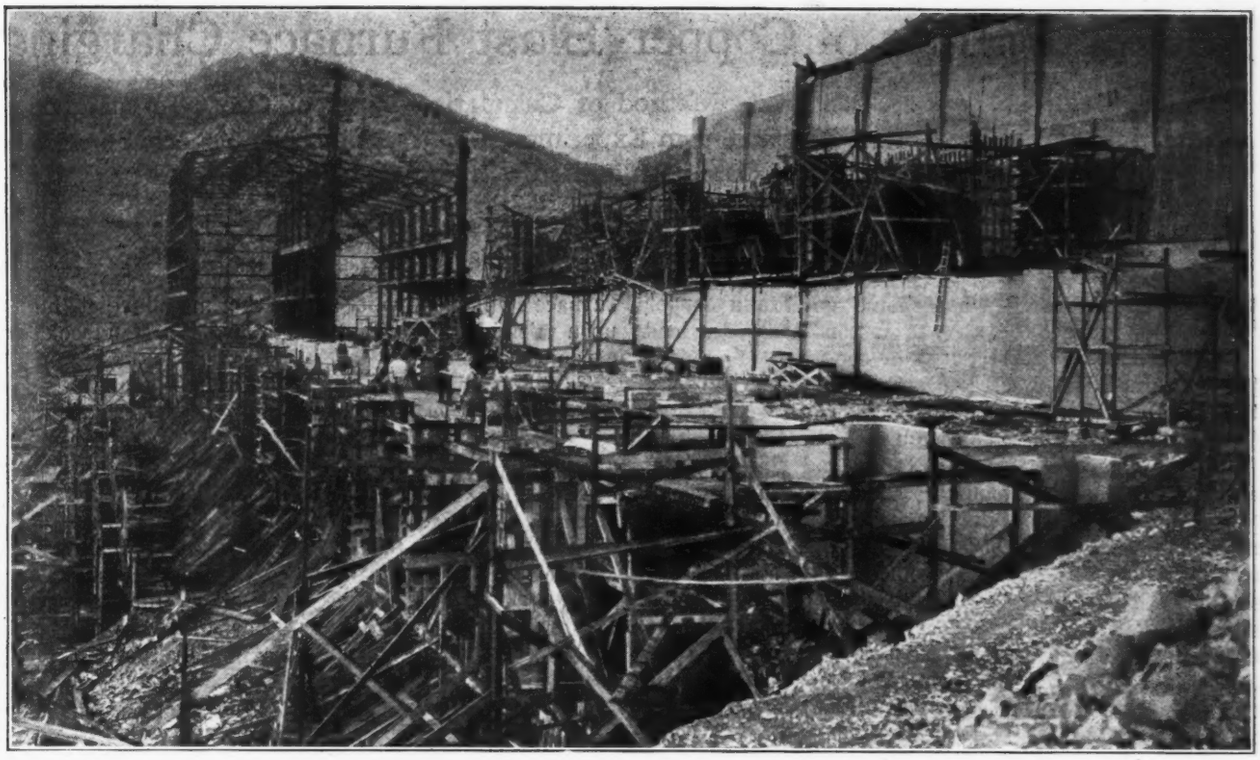
Copper Queen Concentrator, Warren, Ariz.



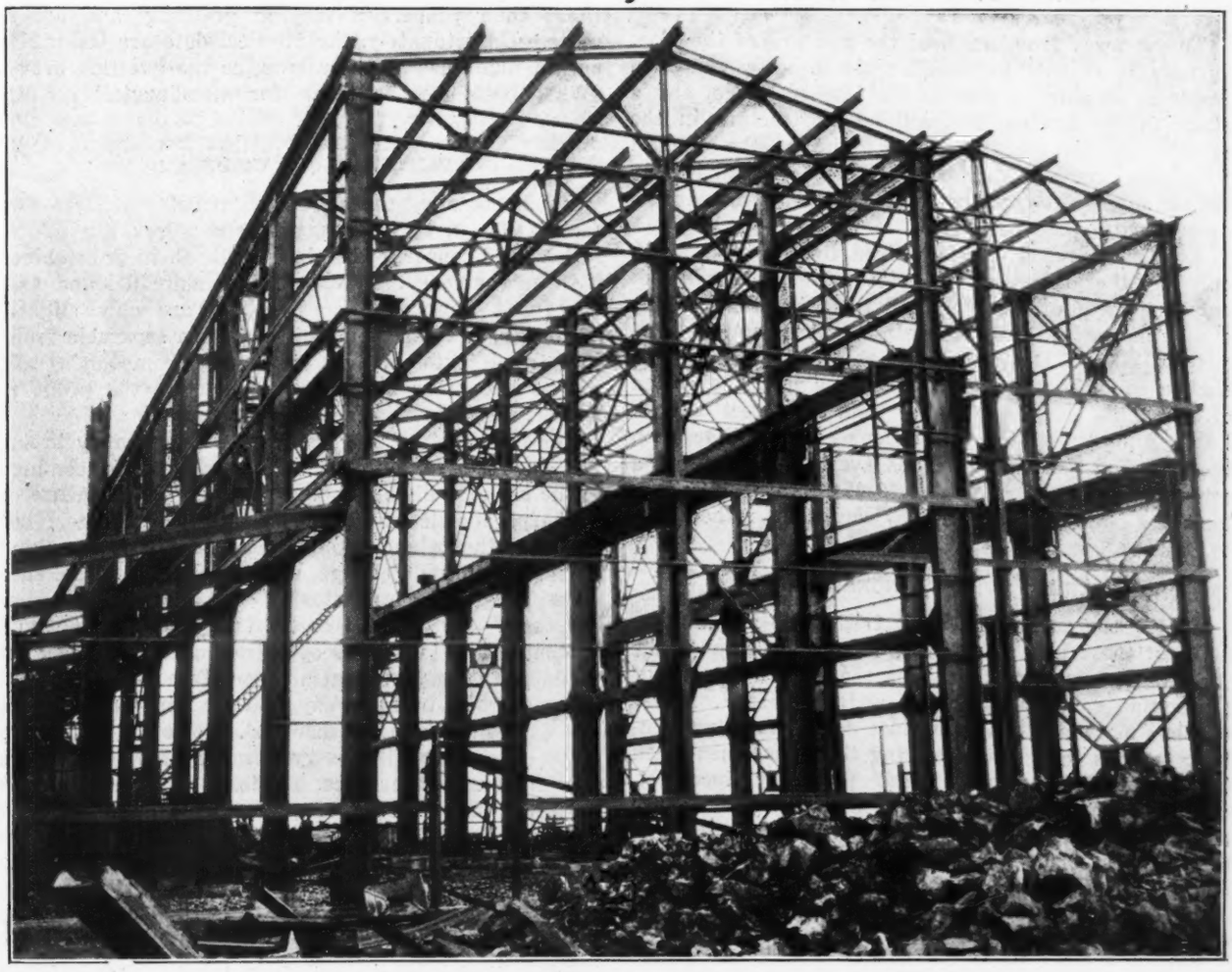
LOWER TIER OF SHOPS AND RAILROAD RECEIVING POINT FOR MATERIALS OF CONSTRUCTION



COPPER QUEEN CONCENTRATOR FROM LOWEST OR SHOP LEVEL



GENERAL VIEW, SHOWING PROGRESS OF STEEL WORK, JUNE 1, 1920



STEEL WORK OF MACHINE SHOP, COPPER QUEEN CONCENTRATOR

The Economics of Copper Blast Furnace Charging

Analyses Not Alone To Be Considered—Method of Calculating Costs of Great Importance—Graphs, as for Slag Losses, Plotted From Experimental Data, Almost Indispensable—Degree of Sulphur Oxidation and How It May Be Varied

BY C. A. GRABILL*
Written for *Engineering and Mining Journal*

TO DETERMINE what should go into a copper blast furnace requires common sense, a lead pencil, and a correct idea of the value of money; the only indispensable requirement is common sense, though often it seems more rare than might be expected. Chemical reactions, heats of combination, melting points, formation temperatures, trisilicates, and similar data, are merely aids to the understanding of the complex action going on within the four walls of the blast furnace, and the moment they fail to simplify the conception of conditions or subsequent calculations they should be dropped, temporarily or permanently, as the situation demands. Some are merely terms used as adjuncts to a theory which is not proved, nor of much importance if proved, and all such terms are but tools of the trade to be used when required, and only when required; otherwise, they are likely to be worse than useless.

SIMPLICITY OF BLAST FURNACE

To get away from much of the mystery of the blast furnace it is well to consider the process going on inside it as akin to that in the kitchen range, and a study of the kitchen fire will help to picture in the mind's eye the conditions that exist in the former. Blowholes, crusts, cold bottoms, and irregularities in the air supply are common to both, as is the blowing-in process with wood fuel.

As for formulas, such as given by Furman, I can only say that in twenty years' experience I have met only one metallurgist who used them in practice; the others, like myself, use the method of "cut and try, and add ten kilos." One reason for this is that conditions change so often that the preparation and application of a formula is more laborious than the direct calculation. Another is that one becomes so familiar with the situation and the materials available that often a correct guess can be made the first time, and in many instances one must be guided by conditions rather than by figures.

PRACTICAL DETERMINATIONS PREFERRED

As for the terms bisilicate, trisilicate, and similar designations, I have found them merely ingenious terms for causing labor and befogging the issue. The use of percentage composition, plain and unadorned, is far simpler, more practical, and just as accurate, particularly because the idea underlying the terms mentioned is certainly disputable if not positively incorrect. Balling's very elaborate tables are a trap for the unwary. The metallurgist should learn to associate the properties of slags with their percentage composition and thus avoid the intermediate calculations. The assay office does not report in silicate ratios, and the furnace will not wait while the metallurgist hunts up a mislaid copy of the "Metallurgist's Handbook" to consult the tables.

To a somewhat similar category belong the type slags of the lead smelter. These type slags were postulated many years ago, and doubtless represented a condition due to the composition of certain ores; but the attempt to apply them to all ores is a failure because the genuine type slag does not exist. The attempt to adhere to one may be a costly hobby. By type slag I of course refer to that hypothesis which stated that in a few slags the silica, lime and iron bore a simple ratio to each other and were therefore superior to other slags of approximately the same composition.

The most practical conception of slags is that they are mutual solutions of a number of silicates containing dissolved substances, all of which are dissociated, and that naturally they follow the laws of mixed solutions, their properties varying gradually and not in units. Unfortunately, the physical data are lacking to permit much use of these laws, so the question arises, "What basis can be taken for metallurgical calculations?"

FUNDAMENTALS OF PYROMETALLURGY

Fundamentally, the pyrometallurgist considers two facts: The first is that gold and silver are soluble in lead and copper, either in metallic form or combined with sulphur, or dissolved in iron sulphide, and that the fused compounds or mixtures are only slightly soluble in, heavier than, and therefore separable from, the fused oxides, their mixtures, compounds and solutes known as slags. The second is the profit to be derived from making this separation.

The first part of this statement is necessarily broad, not for the reason that metallurgists are confined to the use of a bisilicate or a "quarter" slag because of a sharply defined limiting property of silicates, but owing to the balancing of the cost factors. The kind of slag used will change up and down, not because of a change in properties of matter, but in prices and costs. No physical reason is approved that would prevent the design and operation of a furnace that would run on a pure quartz slag with a matte product. The cost would be high; say, $30 per ton. Nor is there any fixed limit at the other end. It is the custom to think of silica as necessary because of its cheapness and universal occurrence. Silicate slags are almost universal, not because of pre-eminent qualities only, but because of their cheapness; otherwise it is conceivable that borates, aluminates and ferrites might be used.

The same may be said of iron and lime as fluxes. In Russia, barium has been used in place of both, and in common with most metallurgists I have used dolomite

*First of a series of three articles on this general subject. Book rights reserved for the author.

instead of limestone. Alkalies would be satisfactory, and, indeed, have been used. The whole question is merely one of cost and by cost I do not mean the price of the article alone but the total effect on operating results.

Costs as Important as Analyses

The metallurgist must, therefore, calculate his charge with the costs as elements just as much as the chemical elements, but to know his costs he must have figured the charge. I once wasted several days developing a formula for the cost of smelting, and ultimately did succeed in getting one that was not outrageously inaccurate, but it was so cumbersome that the waste basket was the only suitable place for it. The only practicable plan of calculation is by approximations. Plotting the results of calculations made by varying one element at a time often gives valuable and unexpected aid.

Slags are usually classed as silica, iron, and lime compounds because of the greatly preponderating proportion of these oxides. Comparison of results at the various copper-smelting plants of the United States will show that the ordinary limiting figures are: SiO_2, 25 to 50 per cent; FeO, 15 to 65; and CaO, 0 to 30 per cent; and 38 per cent SiO_2, 30 per cent FeO, and 22 per cent CaO may be said to represent a fair average condition, and, although not ideal, is still an approximation to that condition. I consider 36 per cent Cu a representative matte, and therefore a fairly satisfactory one.

To obtain these mixtures the metallurgist has available: SiO_2 and its substitutes, acidic; FeO and its substitutes, basic; CaO and its substitutes, basic; S, matte forming, and acidic in effect on the others in removing a portion of the Fe; coke; air (the air must not be overlooked, as it weighs twice as much as the rest of the charge), and miscellaneous impurities. The products of the treatment of the mixture are: Gases, fume, flue dust, matte, and slag.

Now, if the ore contains the first four items in exactly the right amount to produce the ideal slag and matte when the proportion of the coke and air is at the point of maximum efficiency, the metallurgist has an easy task, but a change in the price of coke would throw the operation out of balance. If the coke increased in cost it would be more economical to reduce the amount on the charge, and that would probably imply slower running and a higher-grade matte, more slag loss and more iron oxide in the slag, and consequently a smaller percentage of silica and lime.

Preferred Method of Computation

The metallurgist is confronted by the question as to whether it will pay to buy a siliceous ore to utilize the excess ferrous oxide, and if so what he can afford to pay for extra silica. This question is not a simple one, yet it is the fundamental factor in making up the charge, and recourse must be had to the records of the cost of smelting operations either at the same plant or at similar plants, as a starting point. The oldest method is to base the costs of operation on the ton of ore, irrespective of its composition, and charge against it the cost of the fluxes actually used. Although this is an important figure, as a tool of the metallurgist it is of a decidedly antiquated pattern. The better method is to base all cost statistics of operations on the ton of charge, consisting of the ore and fluxes (but not including secondaries, i.e., foul slag, cleanings, and such materials), but with the original price paid for the fluxes omitted, they being considered exactly as an ore on which a loss is incurred. The price of the ore would not appear either in these figures.

The cost of treatment of a ton of any ore, commonly referred to as the cost of smelting, would then be the cost of smelting a ton of charge plus a correction for the lime, silica, and other fluxes, determined in the manner shown later. Owing to the prevalence of siliceous ores in custom practice, these corrections are usually based on the cost of fluxing a ton (or unit[1]) of silica, but if there are more basic ores than needed this will automatically change the basis to the cost of fluxing a unit of Fe or CaO, as the case may be; in special instances the basis might be on zinc, barium, or sulphur.

Calculations Incorrectly Made Very Misleading

To the metallurgist the manner in which these costs of operation are calculated is of great importance, and I regret to say that it is not often correctly done even by some of the large companies. At the moment of writing I have before me the smelting costs of several companies, and not one of the lot is in a form usable by the metallurgist. This is because most cost systems are devised by an office force, frequently without metallurgical experience, and situated far from the plant. They are designed to be used as a guide from the financial standpoint, or to form a basis of suppositious comparison of work at both mine and smelter, and are frequently very misleading. As above indicated, they should be based on the ton of charge smelted and grouped first by class of operation performed, so that, in considering any particular ore only the costs applicable would be charged against it. Obviously it would not be correct, ordinarily, to charge limestone with a smelting cost that included roasting.

In any ordinary work the costs might be classified as follows: Sampling and assaying; sintering; roasting; briquetting; bedding and recovery; smelting; converting; recovery of fume and flue dust; overhead and general expense; construction and any unusual expense.

The cross classification would be divided according to the effect on increased tonnage: Overhead and general expense; construction; special; fixed expense (those expenses in addition to general and overhead expense and construction which are independent of the tonnage smelted, such as foremen, lights, and like charges); variable expense (those which vary directly with the tonnage smelted, such as coke and ore shovelers); and semi-variable expense (those which vary with the tonnage but not directly, for example, slag motors and matte tappers).

These classification are of course only general; each case requires individual consideration, and in any event each of the above classes will have many necessary subdivisions.

The next matter to be determined is the value of the recoverable metals at the works. There is of course expense in shipping, refining, and selling the product, and this should not appear as an expense of operation, although it may be handled in that way if kept separate from the other accounts. The most convenient system

[1] "Unit" as commonly used, is equivalent to 1 per cent of a ton, or 20 lb.

is to use it in the form of a deduction from the selling price stated in cents per pound or per ounce. Stated in this manner it may be called "marketing expense."

The laws that govern the metal losses are next in importance. "Very easy," says the amateur: "Gold, 100 per cent recovery; silver, 95 per cent recovery; and copper, 1 per cent of the copper contents of the matte equals the copper assay of the slag. Q. E. D. Only there *is* a gold loss, and 5 per cent silver loss is merely the average of a number of discrepancies, and the assay of the slag varies like sin. In these days of high costs and close competition the professional must make a lot better guess than that.

Several years ago I called attention to the fact that the losses of copper in copper smelting were dependent on several factors, of which the solubility of copper sulphide in silicates, the flotation of copper matte by small bubbles of gas, and the solubility of the metal or the oxides due to imperfect mixing of an overblown portion, were the principal causes; and that, in a well-

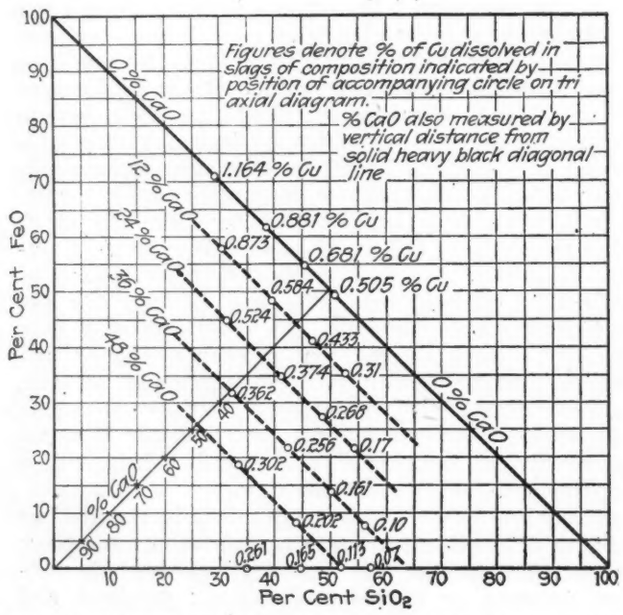


FIG. 1. COPPER CONTENTS OF SILICA-IRON-LIME SLAGS FOR MATTES WITH 30 PER CENT COPPER. FROM EXPERIMENTAL DATA

run plant, the first factor is decidedly the most important, the others coming into action only in case of furnace troubles.

WORK OF WANJUKOV

Wanjukov published, in "Metallurgie," in 1912, the results of some experiments on this solubility, and from his data I have made Fig. 1. Comparison with actual results obtained is satisfactory, making due allowances. Wanjukov's results are usually higher than those found in practice, apparently because his figures are based on slags consisting of pure mixtures of silica, iron, and lime, whereas the ordinary slag contains a number of elements that have a favorable effect, such as magnesia. It should also be noted that the alumina must be calculated as silica. Wanjukov's own plotting of his results in accordance with the silicate degree fails to show this (Fig. 2), but recasting his figures on the percentage basis, with the curve showing the variations in the copper assay caused by the substitution of alumina for silica, unit for unit (Fig. 3), does do so. With the exception of two doubtful results, the maximum variation is about 0.05 per cent. This is, however, the least satisfactory part of his work, owing to the paucity of the data in the area practicable for smelting purposes.

As the result of a comparison of a good many years'

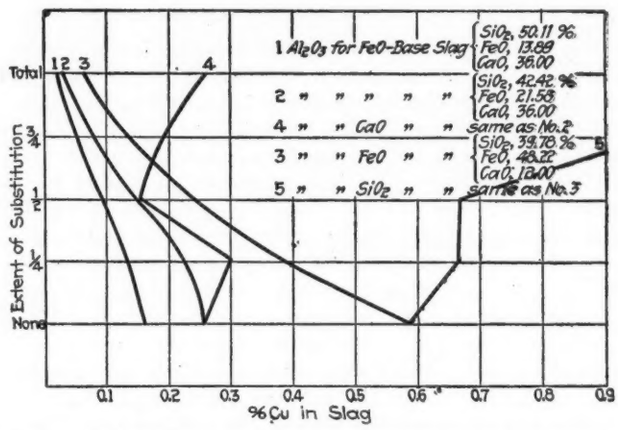


FIG. 2. WANJUKOV'S RESULTS. SUBSTITUTION OF CHEMICAL EQUIVALENTS OF ALUMINA FOR THE OTHER CONSTITUENTS OF VARIOUS SLAGS

work, involving the smelting of ores which have produced matte all the way from 4 to 79 per cent Cu and "black copper," I drew up the curve in Fig. 4.

These two diagrams have helped me immensely in my work, but, as Jeff says to Mutt, "Use discretion." In the first place, as Wanjukov points out, the solubility is dependent on the grade of matte; on the presence of small amounts of other substances than silica, iron and lime; on the temperature; and on the sulphur ions in the slag, the last factor being influenced by the others. I have found that calcium fluoride has a favorable effect, probably owing to reduction of the melting point, and, consequently, of the temperature. Reference to the beneficial effect of the fluoride is found in a Spanish work on smelting published in 1799, so the discovery is not new. The presence of small amounts

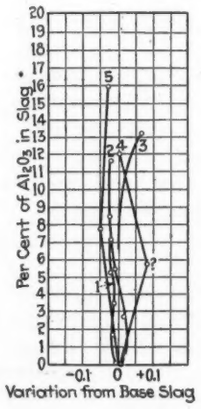


FIG. 3. WANJUKOV'S DATA FOR SUBSTITUTION OF Al_2O_3 FOR SILICA

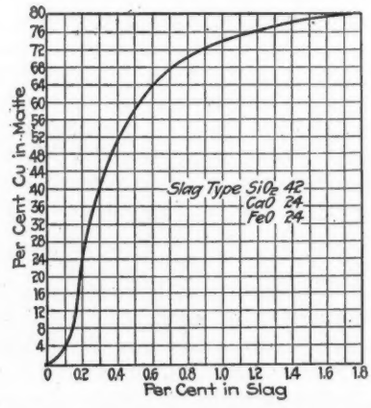


FIG. 4. APPROXIMATE RELATION BETWEEN THE COPPER CONTENTS OF SLAG AND THE ACCOMPANYING MATTE

of *any* base should lower the melting point and influence the solubility.

My own method is to tabulate all the slag assays available at the plant under consideration, plotting them against the grade of matte, silica, iron and lime, differ-

ent classes of ore, furnace speed, matte fall and the ratio between matte and slag to the same factors and to any other factor that might influence the loss, and thus determine the direction and extent to which the primary curve is modified.

Silver losses usually are found to follow the copper. I have never been able, however, to plot a general curve

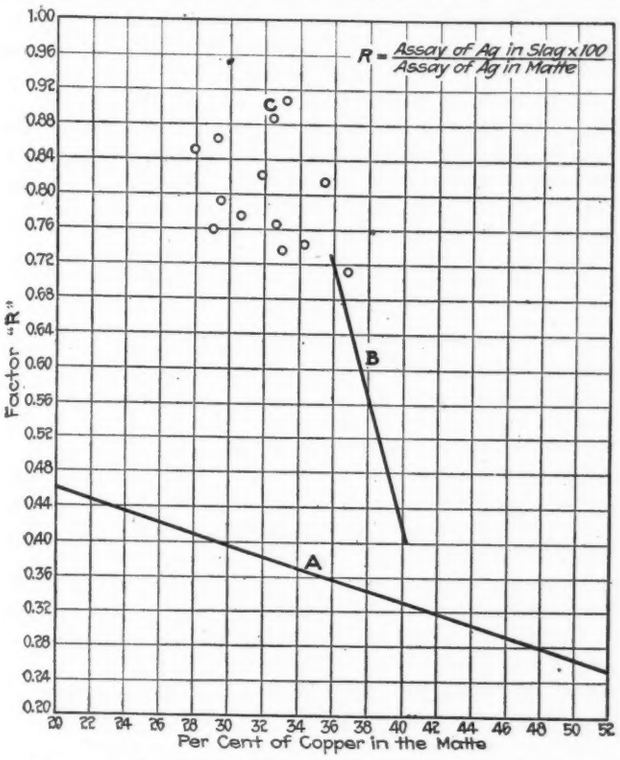


FIG. 5. RELATION BETWEEN SILVER IN SLAG AND COPPER IN MATTE

in the same way as for copper, apparently because the graphs which represent the effects of the various influences do not have a uniform curve; and the compound curve formed by a combination of the simple curves is therefore erratic.

ILLUSTRATION OF CURVE READINGS

In Fig. 5 I show a graph of the results obtained at three different plants. Curve *A* was drawn from results that harmonized well among themselves. Curve *B* was for a similar grade of matte, and the slag did not vary much from that in *A*, but there is no resemblance between the constants in the two cases. Curve *C* is merely a collection of points which have no resemblance to a curve, and it is apparent that any relationship that exists between the silver in the slag and the copper in the matte is masked by some much more important factor. *R* is simply the ratio, expressed in percentage, that the assay value of the slag was to the assay value of the matte. If, however, the points of *C* are plotted in accordance with the silver in the mattes, they fall into a regular curve, with two exceptions, as shown in Fig. 6. The dotted lines show the effect on the factor *R* caused by the minimum error of weighing in making the assays.

The differences between these curves were all explainable. When the amount of silver in the matte is small, variations in it have an important effect, but the collecting power of the copper in the matte is not of much effect. When the silver becomes a considerable part of the matte, as in *A* and *B*, the solvent effect of the copper overshadows changing amounts of silver.

The difference between *A* and *B* was due to certain constituents of one of the ores at the *B* plant, and other local conditions. These curves are inserted merely to show how easily incorrect conclusions may be reached and the care that must be taken in the use of these tools. Deductions from them always should be verified by direct experiment where possible, but with suitable precautions the use of curves in this manner is of more value than incomplete experiments, with the presumption, of course, that the curves represent the plotting of results obtained from much more work.

Consider the curve shown in Fig. 6 for example. The points on this curve represent about 800 samples taken during a year's work. The results and the deductions from them, therefore, are much more to be depended upon than conclusions reached from a few days' test. The curve could not be applied to the work of another plant without full knowledge of all the circumstances, but that fact does not destroy its value. Consider Curve *B* of Fig. 5. The fact that the steep pitch of this curve was due to strictly local conditions was of help in determining and controlling them, and although the steepness was apparently due to the collecting power of the copper, in reality it was attributable to certain influences which in this instance coincided with the grade of the matte. Impurities in the sulphide ore were one of the causes. The curve in Fig. 6 is shown as a straight line, but in reality is bowed slightly, with the concave side upward.

As far as my experience goes, the slag composition has more effect on the gold loss than do the copper or gold values in the matte.

The volatilization of silver must be remembered, but that of gold and copper is without importance except in the presence of chlorides. With baghouses and Cot-

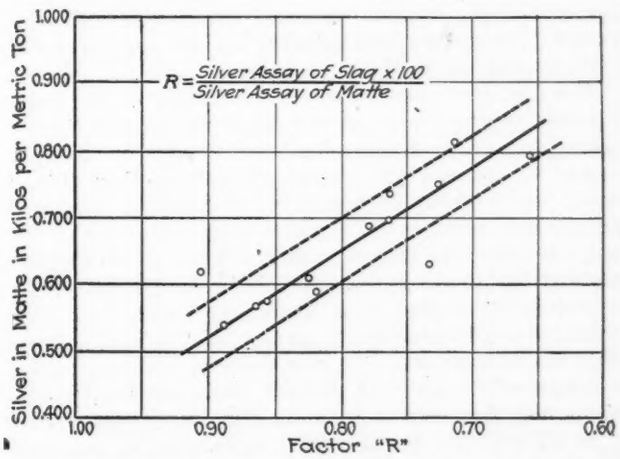


FIG. 6. RELATION BETWEEN SILVER IN SLAG AND SILVER IN MATTE

trell plants the volatilization of silver may be neglected. Of course this refers to the fume and not to the flue dust question, which must always be watched.

LIMIT OF ERROR MUST BE WATCHED

In plotting the assays of slags it should be remembered that the personal equation of the assayer, and the cupellation losses have a large percentage effect on the assays. Also, that a small flotation bubble of matte in

one sample will throw a number of assays out of balance, and yet these bubbles help to make up the average loss. Similarly, the limit of error in the ordinary slag assay is about 5 per cent, so that a close agreement with a theoretical formula is not to be expected. It is precisely for these reasons that the use of formulæ and curves is desirable. They do away with a constantly recurring error of judgment. It is easy to say that the slag from a certain 40 per cent matte will contain 0.3 per cent Cu, and so to calculate it, and the probable error is not large; but if it is found from tested curves that the true assay under the circumstances is 0.33, and that this extra 0.03 is due to the presence of a particular ore on the charge which comprises only 50 per cent of the total, then instead of an error of 0.03 per cent there is one of 0.6 per cent, or 12 lb. of copper for the offending ore, and $2.64 per ton with 20-cent copper, which is of importance.

Properly tested curves are simply tools corresponding to the vernier on the transit, and permit the metallurgist to read his calculations a decimal place further than he could otherwise.

Sulphur Oxidation an Important Consideration

Another important item is the percentage of sulphur recovered, but to make graphs for this factor is not of much use. Peters, I believe, says to assume the grade of matte that previous experience indicates will be produced. This is not much comfort for a new man, at a new plant, with a new ore. Sticht and Freeland are responsible for the doctrine that in pyritic smelting the oxidation of the sulphur, and, therefore, the amount recovered and the grade of matte produced, are controlled by the amount of free silica present. My own experience with pyritic smelting is limited, but with semi-pyritic smelting and straight matting, I must confess that I have not been able to identify that effect.

On the other hand I do believe that the metallurgist can control the sulphur recovery within wide limits by varying the quality and quantity of the coke, aided a little by changes in the air supply.

The first important factor is the quality of the coke. I recall an experience at one plant where the change from large, firm English coke, to small, brittle Connellsville, dropped the grade of matte, other things being equal, about 50 per cent. Pocahontas coke will permit the recovery of a much higher portion of the sulphur than will Dawson coke. I know of no definite method for grading coke on this basis, but an ocular examination coupled with analytical results will give a fair idea of the results to expect in practice. I think that the burning test in a tube, determining the relative amounts of CO and CO_2 formed under standard conditions, together with a crushing and sizing test, should give satisfactory results, but I have seen no comparative tests to substantiate this belief.

With smooth-running furnaces and average coke there is not as great a difference in the sulphur oxidized as is commonly believed. Most of the large differences reported are due to methods of calculation. One plant will base figures on sulphur volatilized, and count everything except the sulphur in the matte as volatile sulphur, neglecting the sulphur in the fume, dust, and slag; another will include the sulphur in returned matte and secondaries as part of the sulphur on the charge.

With a large coke charge the returned matte in the furnace will undergo little oxidation, but when the coke charge is reduced, as in concentration charges, the sulphur in the matte will be oxidized, though never to the extent that it is in the ore. Probably the correct way would be to assume a factor, based on experiment, for the oxidation of the returned matte, varying from nil at 16 per cent coke to, say, 40 at 6 per cent, but this factor would have to be varied with the quality of the coke. The sulphur oxidized is also influenced by the amount of copper on the charge, which has a protective influence when the ratio of copper to sulphur is large.

In a rough way, about 15 per cent of the sulphur in the crude ore will be recovered in the matte with 10 or 12 per cent of average coke on the charge. This figure will vary 5 per cent either way, depending on the quality of the coke, and another 5 per cent depending on the amount and manner of driving.

Metallurgist's Schedule Is Guide to Mining and Treatment

With the information indicated, and the cost and analysis of his base ore and fluxes (iron ore, sulphide flux, limestone, and quartz), the metallurgist is in position to make his calculations to see what price can be paid for the ores available in the district, whether they are from the company's own mine or purely custom ores, because, however carried in the cost system current at the smelting works, the metallurgist should prepare a schedule or tariff, from which the proper method of mining may be deduced. Otherwise the miner is working inefficiently and in the dark. This tariff should fix a treatment charge; a premium for all valuable elements, and a penalty for all harmful ones; premiums for increased tonnage, if desirable, and all so arranged as to promote the utmost economical development of the company's property.

The mine superintendent may say, "I can reduce mining costs per ton by including a little low-grade stuff from the walls. Shall I do it?" The metallurgist's tariff, combined with the mining costs, should answer the question definitely to the best interests of the company. With custom ores the question is different, in that provision must be made for a suitable profit. (The word suitable covers all requirements and is charitable.)

Discoveries of Copper Ore in Northern Finland

Two mining companies, the Finland Copper Co. and the Salla Mining Co., have bought some large deposits of copper ore, according to Consul L. A. Davis, which have been discovered in Kuolajarvi Parish, in the Oulanka River Valley, in northern Finland. Geological examinations have shown that the copper near the surface is rich, and if exploration and tests are made with the diamond drill it can probably be ascertained whether mining on a large scale will be profitable or not. The directors of the companies have applied for a government subsidy for this purpose, as security for which they offer shares of old stock at a nominal value of 200,000 Finnish marks.

They had planned diamond drilling last year, but contented themselves then by blasting with dynamite, which was carried on by a German engineer. In his opinion nineteen claims are so rich in copper that diamond drilling ought to be undertaken to ascertain if mining can be carried on profitably. There are also rich veins of iron glance and of sulphur pyrites in the same place, the latter amounting to several million tons.

Gold Dredging—Actual Recoveries Compared With Estimates

The Accuracy of Prospecting Drill Methods as Illustrated by Examples That Have Been Taken From Practice—Factors That May Be Used To Reduce Sampling Error—Churn Drilling a Satisfactory Method of Prospecting Gold Placers

BY W. H. GARDINER

Written for *Engineering and Mining Journal*

DREDGING possibilities may easily be investigated and prospected—not only the value per cubic yard estimated with much accuracy, and the cost of operation predetermined with precision, but the extent of the deposit may be ascertained before recovery is begun. If the margin of profit is attractive, outside capital is not invited. If unfavorable, even the most plausible promoter has little to offer—which is why so little stock in dredging companies is offered to the general public.

With lode mining it is different: the element of speculation is much higher. A risk is to be shared, instead of a certainty jealously guarded. It may be said that the prospecting of a quartz mine is an investigation in three dimensions; a dredging property in two. A placer deposit covers a hundred or more acres and is 20 to 8 ft. in depth. The vein of ore would have to be exposed entirely on one side to be appraised with equal accuracy.

SAMPLING DREDGING GRAVEL

The churn drill, steam or hand power, has been widely used in the last twenty years to determine the gold contents of dredging gravel. Heavy casing, fitted with a beveled-edge cutting shoe, is driven to bedrock. Every foot or two the sand, gravel, and boulders, loosened and broken by a heavy drill, are panned and the gold is recovered. Care is taken to keep the core to about the volume displaced—always maintaining a few inches of gravel between the bottom of the shoe and the pump to prevent the crowding out or forcing in of material not in the path of the pipe.

Vast acreages of gold-bearing gravels have been exploited throughout the world on the simple story of the drill. Even greater areas have been explored and "turned down." Sometimes check shafts were employed, but more often water would not permit them. For many years the prophesied returns have been checked closely by actual recovery.

ACTUAL RECOVERY ESTIMATES

Variable factors cannot be eliminated in making such comparisons—the personal equation and methods of estimating. Not all drilling has been done by the same engineer, with like crews or similar equipment. On one property the drilling yielding high assays was checked by more in the same locality, and the final results were enriched by averaging all these favored holes. On another the work was done in winter—the panner working in ice-cold water under inadequate cover. The figures given herewith, however, are generally from the records of conservative, experienced engineers and successful companies.

In drilling a level, extensive "blanket" deposit, holes are customarily put down at the corners of regularly plotted rectangles. The prospecting of a stream or channel, on the other hand, necessitates a line of holes close together, these lines being repeated at considerable distances apart—a cross-sectioning, so to speak. The final estimate must allow each hole to "govern" only the proper amount of area.

The conservative engineer figures 33⅓ cu.ft. of gravel to a hundred feet of pipe (7½ in. cutting shoe). The more optimistic prospector, on the other hand, has figured 27 cu.ft. Today it is not uncommon to figure 30 cu.ft. (there being 30.68 cu.ft. in a cylinder 100 ft. long and 7½ in. in diameter). A table follows showing a short-cut to drill-hole estimates, the factor being 33⅓.

TABLE FOR FINDING VALUE PER CU. YD. FROM TOTAL AMOUNT OF GOLD RECOVERED BY DRILL

Diameter cutting shoe 7½ in. Constant 33⅓. To find value in cents per cu. yd. multiply number of milligrams of gold recovered from drill hole by the number in table opposite depth to bedrock.

Depth to Bedrock in Feet	Factor	Depth to Bedrock in Feet	Factor	Depth to Bedrock in Feet	Factor
10	.4860	26.5	.1834	43	.1130
10.5	.4629	27	.1800	43.5	.1117
11	.4418	27.5	.1767	44	.1105
11.5	.4226	28	.1736	44.5	.1092
12	.4050	28.5	.1705	45	.1080
12.5	.3888	29	.1676	45.5	.1069
13	.3738	29.5	.1647	46	.1057
13.5	.3600	30	.1620	46.5	.1045
14	.3471	30.5	.1593	47	.1034
14.5	.3351	31	.1568	47.5	.1023
15	.3240	31.5	.1543	48	.1013
15.5	.3135	32	.1518	48.5	.1002
16	.3037	32.5	.1495	49	.0992
16.5	.2945	33	.1472	49.5	.0982
17	.2859	33.5	.1450	50	.0972
17.5	.2777	34	.1429	50.5	.0963
18	.2700	34.5	.1408	51	.0953
18.5	.2627	35	.1388	51.5	.0944
19	.2558	35.5	.1369	52	.0935
19.5	.2492	36	.1350	52.5	.0925
20	.2430	36.5	.1331	53	.0917
20.5	.2371	37	.1313	53.5	.0909
21	.2314	37.5	.1296	54	.0900
21.5	.2260	38	.1279	54.5	.0892
22	.2209	38.5	.1262	55	.0884
22.5	.2160	39	.1246	55.5	.0876
23	.2113	39.5	.1230	56	.0868
23.5	.2068	40	.1215	56.5	.0860
24	.2025	40.5	.1200	57	.0853
24.5	.1984	41	.1185	57.5	.0845
25	.1944	41.5	.1171	58	.0838
25.5	.1906	42	.1157	58.5	.0831
26	.1869	42.5	.1143	59	.0824

Bear in mind that the engineer is not so much concerned with the actual total gold content as with the amount that of a dredge will recover. There are no data available as to the percentage that escapes the riffles—certainly over 5 per cent but probably under 20 per cent, conditions being ordinarily favorable.

A carefully prospected property will have a hole to every two to five acres. Sometimes the actual returns of dredging along one side of an area will reduce the drilling necessary to forecast the value. Some deposits have been perforated with holes in a feverish endeavor for meticulous accuracy. With one or two notable exceptions, all drilling in excess of one hole to two acres was so much wasted energy.

The estimated returns of the long-continued operations of the Butte Dredging Co. and the El Oro Dredging Co. may be tabulated as follows:

Location	Company	Estimate	Recovery, Cents per Cu.Yd.
Oroville, Cal.	Butte Dredging Co.	25.0	13.09
Jenny Lind, Cal.	Butte Dredging Co.	22.0	18.30
Oroville, Cal.	El Oro Dredging Co.	47.0	16.50
Yuba, Cal.	El Oro Dredging Co.	15.0	15.44

It will be noted that actual returns at Oroville were much less than expected. The management accounts for this by the fact that the gravel was somewhat cemented—bound together by clay that interfered with complete washing. The tailings from other operations in this neighborhood have been reworked at a profit, the air-slacked chunks yielding up their gold to rewashing.

The Yosemite Dredging & Mining Co., at Snelling, used a factor of approximately .27, but discounted final figures by 20 per cent as a factor of safety. Unusually high assays were cast out. Ground was loose and gold was well distributed. One piece of thirty acres, carefully prospected, showed a recovery of 6.74c. per cu.yd., against an estimate of 4.44c. Final returns, after working some acreage of much more compact deposit, showed a recovery of approximately 15 per cent greater than drill results.

In somewhat similar ground, although located at the Calaveras River, the Isabel Dredging Co. reports a much greater recovery than expected. On one piece of twenty-three acres, covered by twenty-five holes, the estimate was 2.35c. and the recovery 8.8c. Here, as elsewhere, it has seemed that the drill fails to recover all gold in certain kinds of gravel.

Further Examples

The Yuba Consolidated Gold Fields, at Hammonton, Cal., with its fleet of huge dredges digging 80 ft. below water level—five of them individually handling 300,000 cu.yd. per month—have washed an enormous volume of gravel. Some of the operations were carried on with little exploration, it being known that it would be profitable to work certain acreages from results on bordering tracts. Results as a whole have checked estimates closely, although many times there has been a wide variance in individual blocks. For instance, recovery in one tract was within a tenth of 1 per cent of the forecast; in another only 60 per cent; in a third 195 per cent—the three tracts involving a total of over 500 acres.

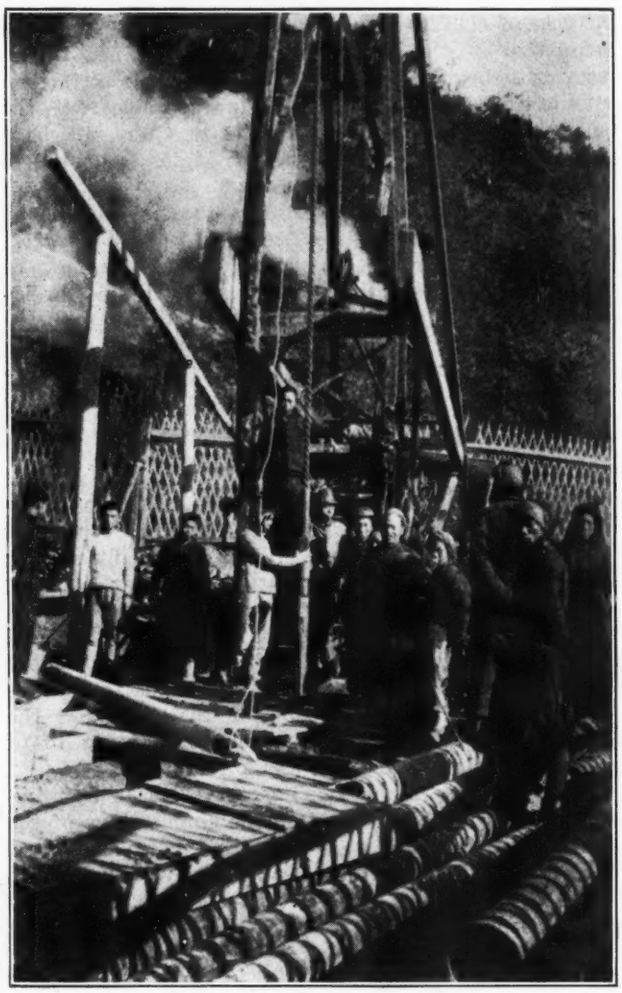
Perhaps no stream deposit has been more carefully drilled than the ground of the Powder River Dredging Co., at Sumpter, Ore. Dredge No. 1, in the lower valley, worked in deeper ground—a field prospected by two different crews at different seasons, although under the same engineer. On the shallower up-stream areas Dredge No. 2 operated over a rough, hard bedrock. Dredge No. 1, in 369.5 acres, showed a gain of 39.8 per cent over the estimate. Dredge No. 2 failed by 7 per cent to yield to expected returns. Refiguring the latter property to a factor of .3068 would show an almost exact check of estimate and recovery.

The discrepancy of the results of Dredge No. 1 may be partly explained by the presence of a narrow but rich "pay streak" that meandered down the creek, dodging most drill holes, and failing to make itself apparent when tapped. The very irregular bench line caused a marked variation between estimated and workable *area*.

On the extensive properties of the National Companies, of California, on the American River, there occur many widely differing conditions—heavy wash and cemented gravel on the benches and broad acres of more shallow, softer ground down-stream. A check made four years ago on the operation of three dredges resulted as follows:

Dredge	Area, Acres	Time of Operation, Years	Per Cent of Estimate Recovered
No. 5	180	10	86
No. 8	106	4	87
No. 9	135	6	101

These results are based on a factor of .30. During the last four years these dredges, as a total, have produced about 101 per cent of the expected recovery.



A KEYSTONE DRILL IN KOREA WITH A FENCE TO KEEP OUT PREDATORY NATIVES

"Old No. 1," worked in 25-ft. ground—loose and easy to dig—recovered 125 per cent of the drill returns, these being figured with a .27 factor. In a soft sandy deposit on the Sacramento Bar the actual dredging results fell far short of the estimate. It will be noted later that probably the pressure of underground water forced gold into the casing. On the benches, where clay was encountered, there have been notable instances of the failure of actual dredging to give estimated returns, fine gold having been lost in the muddy water. On the acreage worked by Natoma No. 7, the returns held up to the estimate as long as the gold

was reasonably coarse, but on the edges of the deposit, where there were areas of fine gold, returns would immediately drop below expectations. It was concluded that the drilling was accurate enough, but that the size of gold particles affected recovery in the unavoidably dirty water.

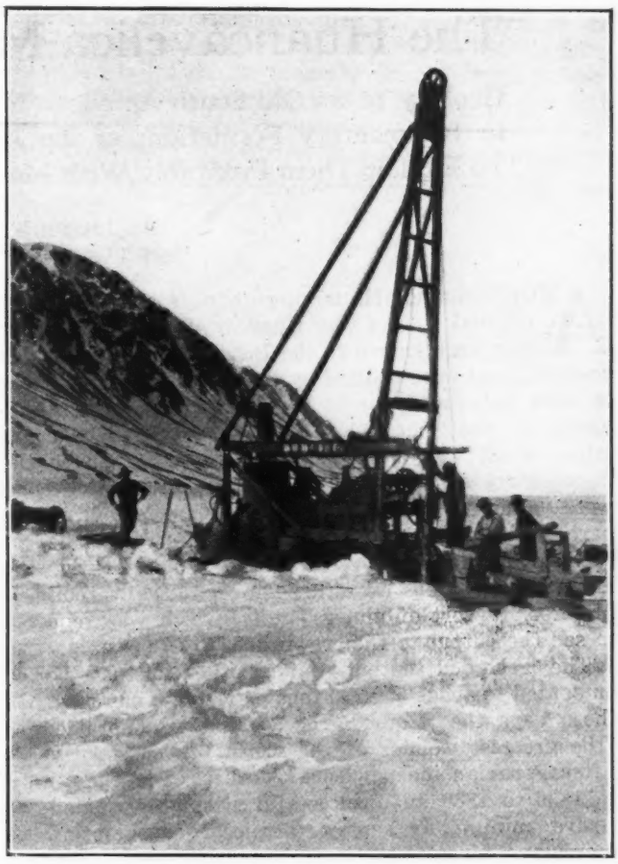
Other reports are available, but sufficient evidence has been produced to confirm important conclusions recently advanced by dredge engineers.

It may be observed that the accuracy of results gained by drilling is surprising, considering the comparatively small size of the sample. For example, one hole to two acres in 50-ft. ground would mean that $\frac{1}{328,000}$ part of the gravel was examined. Of course one hole by itself means nothing—it is only a carefully charted series that reliably represents actual conditions.

All available data seems to point to the following facts regarding the accuracy of drilling:

1. Drill results give high assays where gold is fine.
2. Estimates will tally with returns where gold is reasonably heavy, ground is compact with a little clay, and prospecting and dredging are intelligently done.
3. The drill will exaggerate the value of *very* loose ground where sand or water pressure crowd material into the bottom of the pipe.
4. The drill will signally fail to show recoverable gold in areas of moderately loose ground where gold is distributed and in comparatively small amount.

This fourth conclusion is of considerable importance. Dredging at Jenny Lind, at Natoma, at Yuba, on the Merced, at Cottonwood, and many other places has proved its truth.

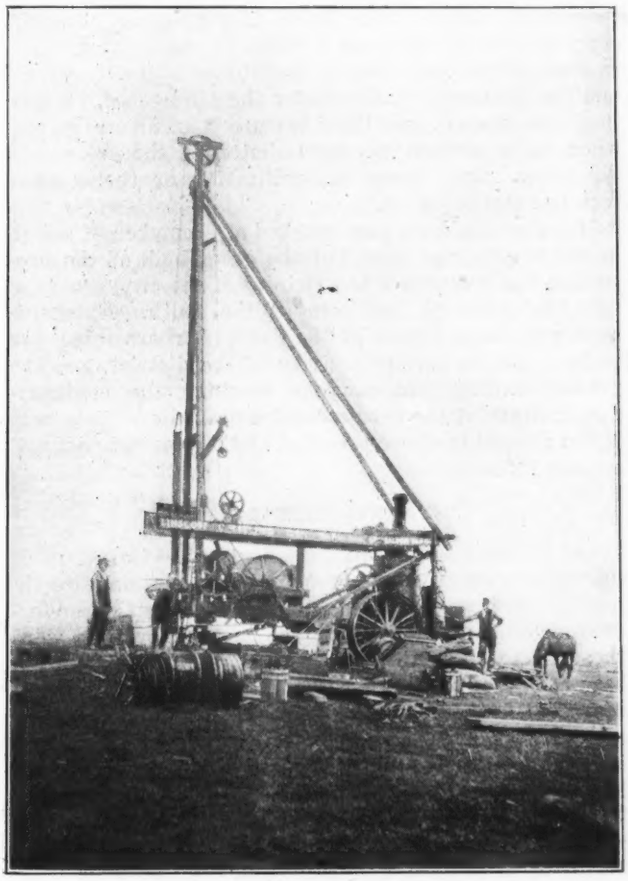


DRILLING OUTFIT ON CHISTOCHINA RIVER, ALASKA

James W. Neill, in writing on the subject, says: "If the driller keeps his bit behind his shoe, and sees that he gets a correct amount of core, there should be little question of the correctness of a *large general average*, and the engineer can use such factors of safety as his experience and the character of the ground indicate. In very loose ground, I personally look for a recovery of full drill values where the gold is coarse and is entirely contained in the foot or two above bedrock. I think one will usually also overrun the drill, provided the bedrock can be dug. That is about the sum of our experience at Snelling."

In loose ground the drill churns up the gravel and crushes stones before pumping. Its jarring action induces the settling of the gold, making it most difficult to procure by pumping. On the other hand, very loose sandy ground with free water content may force gold into the pipe, even if pains are taken to keep the core within safe limits. This explanation partly accounts for the recovery of 8.79c. in a Colorado property where the drill sheets indicated 17.19c.

When a certain readjustment of economic conditions or legislative relief increases the value of gold in terms of commodities, there is destined to be a renewed interest in dredging. Most of the gold-bearing river gravels of Oregon, Montana, Idaho, Colorado, Arizona, New Mexico, and California have been drilled by dredge capitalists, and the vast majority of the possible fields rejected as too low in value or too difficult to dredge. The modern dredge man, with improved machinery and methods, fears the boulders, the clay, and the deep or hard bedrock much less than a half-dozen years ago. Engineers will review properties once rejected.



A DRILL OPERATING IN CALIFORNIA

The Huancavelica Mercury Deposits, Peru*

Geology of an Old South American Mining District Located at Great Altitudes in Sedimentary Formations of the Andes, and Difficult of Access—Attempts To Exploit Them Profitably With Modern Mining Methods Now Being Made

BY JOSEPH T. SINGEWALD, JR.
Written for *Engineering and Mining Journal*

AMONG the notable mining districts of the Spanish colonial empire was Huancavelica. The mercury ores were known to the Incas before the Spanish conquest, and were utilized by them as a pigment. There is some uncertainty as to the exact date of their discovery by the Spaniards. In 1570 the Santa Barbara mine, which was already productive, was sold to the Spanish crown, and henceforth all mercury discoveries were declared crown property. Mismanagement on the part of the administrators sent out from Spain led to such poor financial results that subsequently the Huancavelica mines were turned over to the "Gremio de Mineros," a sort of miners' guild, which was required to sell the output to the crown at a fixed price.

The recorded output during the colonial period amounted to about 550,000 tons of metallic mercury. In those days the Santa Barbara mine was heralded as "the greatest wonder of the world." For some years after Peruvian independence the district lay idle, until in 1836 to 1839 an unsuccessful attempt was made to revive mining to supply the local consumption of mercury. Since that time there have been desultory operations resulting in a small annual production. In the early history of the district, mining was often carried on in a haphazard and unsystematic way; and, in the eagerness to extract the richer ore, pillars were robbed without regard to the safety of the mine, so that several disastrous cavings occurred, and a few years ago the old workings of the Santa Barbara mine were practically inaccessible.

RECENT DEVELOPMENT

About 1915 E. E. Fernandini, the well-known Peruvian mine operator, bought up a large part of the district, including nearly the whole of the old productive area about the Santa Barbara mine. Mr. Fernandini has had the old Belen Tunnel cleaned out, opened up a part of the workings at the Brocal, and has started a new crosscut tunnel to get under the main creshoot of the Santa Barbara mine. He has also erected experimental furnaces to work out an efficient method of treating the ore. The district gives promise, therefore, of once again becoming an important contributor to the mercury production of the world.

The city of Huancavelica is situated in the valley of the Huancavelica River, a branch of the Mantaro River, on the eastern side of the Western Cordillera, at an elevation of 3,792 meters. Its former importance is attested by the ruins of ancient buildings and by the eight churches which still try to eke out an existence at the expense of the diminished and impoverished population. Today it is a backward town of several thousand inhabitants, consisting almost entirely of Indians.

Formerly access to Huancavelica was by way of the port of Pisco. This necessitated a five-day muleback ride of 370 kilometers, involving crossing the Cordillera at an elevation of 4,900 meters. The completion of the railroad to Huancayo, made the district more accessible, but even the trip from Huancayo to Huancavelica requires a journey of 120 kilometers, or two days, on muleback over a highly accidented trail. A further extension of the railroad to Ayacucho is under construction and should soon be completed as far as Izcuchaca, at the mouth of the Huancavelica River. The district will then be only fifty kilometers from the railroad, and if the prospecting that is now being done is rewarded with the hoped-for success, doubtless the construction of a spur to Huancavelica will be the next step.

GENERAL FEATURES OF REGION

The prevailing rock of the district is Cretaceous limestone, in which are intercalated zones of sandstone and shale. Outcropping over considerable areas are limestone conglomerates. The sediments are intruded by large masses of basalt and porphyrite, and along the mineralized zone are small andesite intrusions. A mineralized belt extends discontinuously from Chunamachay in a southeasterly direction through Huancavelica to beyond San Antonio, a distance of about sixty kilometers, and has a width of one to three kilometers. It follows a belt of sandstones in the limestone, and the ore usually impregnates the sandstones. Where they are compact and their texture is unfavorable, and when the limestone has been shattered, the ore enters the latter rock. Some mineralization of the igneous rock has also occurred.

Mercury ores have been worked at a number of points in the mineralized zone, but the great bulk of the production has come from the vicinity of the city, from the hills that overlook the town on the south. Extensive workings there, known as the Santa Barbara mine, are evidence of the former activity of the district, and the present explorations purpose reaching the continuation in depth of the old productive orebodies. This part of the district is, therefore, that of the greatest past and present interest.

THE SANTA BARBARA MINE

The old Santa Barbara mine consisted of a group of outcrop workings on the top of the mountain directly south of the city of Huancavelica and extensive underground workings, of which the most important were those of the Belen Tunnel. Most productive seem to have been the vicinity of El Brocal and the Hundimiento Morroqui, two large open cuts, the size of which is due, however, largely to the collapse of underground workings. The Brocal is at an elevation of 730 meters (2,400 feet) above the level of the Huancavelica River.

The most elaborate work in the early history of the mine was the driving of the Belen Tunnel, which was begun between 1601 and 1617, and completed in 1642. It had a length of 600 meters, a width of three to four meters and in places was four meters (13 feet) high. The

*George Huntington Williams Memorial Publication No. 3.

entrance to the tunnel became the center of operations for the mine. It cut the orebody at a depth of 160 meters, beneath the Brocal. The ambition to reach the orebody at much greater depth is represented by the beginnings of the Pochcoco Tunnel at an elevation of fifty meters above the river, or 520 meters below the south of the city of Huancavelica. Rising precipitously above the city is a series of steep westerly dipping beds, which are called on the map the Grand Farallon limestones. They are characterized by wide and frequent variations in chemical composition. There are transitions from pure limestones, through increasing argil-

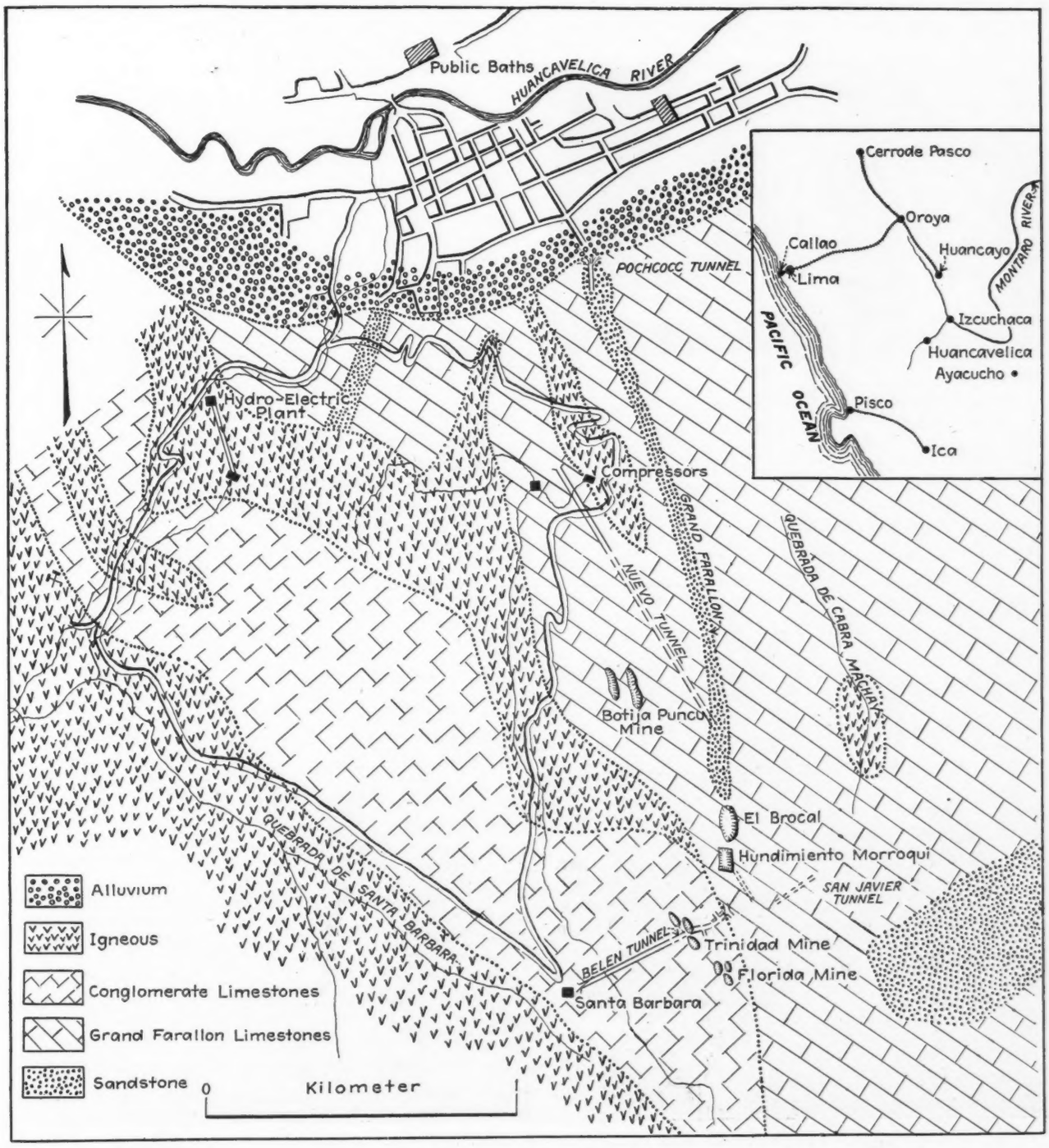


FIG. 1. GEOLOGIC MAP OF CENTRAL PART OF HUANCAVELICA DISTRICT, PERU

Belen Tunnel. This work was abandoned after penetrating only 60 meters. A new attempt to get beneath the Santa Barbara orebody is now being made by Mr. Fernandini, who is driving a tunnel at an elevation of 350 meters above the river, or 220 meters below the Belen Tunnel.

Fig. 1 is a geologic map of the area immediately laceous content, into shales, and, through increasing silica content, into sandstones and quartzites. A well-marked horizon of cherty limestone characterized by bands and nodules of chert lies about 250 meters above the Grand Farallon sandstone. Most abundant in this series are beds of argillaceous and siliceous limestone.

A prominent feature of these beds is a great ledge of

massive and in many places remarkably porous sandstone. It extends across the river in a direction a little west of north at the town of Huancavelica. On the south side its outcrop is so prominent that it is called the Grand Farallon. In the mass of debris and old dumps about the cave-in of the Hundimiento Marroqui this prominent sandstone outcrop suddenly disappears. With like abruptness a similar sandstone with equally

FIG. 2. THE GRAND FARALLON SEEN FROM THE PLAZA DE INDEPENCIA, HUANCAVELICA. DIFFERENCE IN ELEVATION ABOUT 2,000 FT.

prominent outcrop appears 600 meters to the southeast and swings around to the northeast toward the Huancavelica River some distance below the city. On account of the mass of debris which covers the ground on each side of its outcrop the contact of the Grand Farallon sandstone with the adjacent beds is generally obscured. On top of it—that is, on its west side—is a horizon of shale nearly 100 meters thick, in which there are gray, red, and green zones. A similar series of shales overlies the heavy sandstone southeast of the Grand Farallon, but here the sandstone and the shales are much thicker than in the Grand Farallon. The great sandstone outcrops appear to belong to opposite limbs of an anticline, the axis of which pitches toward the southwest and the nose of which has been faulted out.

A second series of limestones extends from the southwest corner of the map in a southeasterly direction to the Belen Tunnel and the Hundimiento Morroqui. The upper part and the greater thickness of this series consists of a conglomerate, the pebbles, boulders, and cobbles of which are limestones. The fragments range in size from small pebbles to cobbles more than twenty centimeters in diameter, and in general are but little waterworn and rounded. The matrix of the conglomerate varies from fairly pure calcium carbonate to a reddish sand material. The lowest beds of the series are not conglomeratic.

The Conglomerate limestones have been regarded by some as late surficial deposits, but their strike and dip and their relation to the present topography are such as to indicate that their origin has no relation to the present surface. On the other hand, their relation to the Grand Farallon limestones is not known. Where the two series come in contact, at the Hundimiento Morroqui and to the south, the beds are much disturbed and outcrops very meager. The beds are older than the period of mineralization, as ore deposition has taken place within them.

Several igneous intrusions outcrop within the area of the map. For the most part the rocks are highly altered. In general character they appear to be of andesitic composition, and such differences as are noted are probably due mainly to minor variations in chemical composition and to variations in texture. The area in the southwest corner of the map is the edge of an extensive igneous mass. At its base, that is, between it and the Conglomerate limestones, in the canyon below the Belen Tunnel, is a horizon of stratified tuffs. A large intrusion also separates the two series of limestones over most of their outcrop. In addition to these, several smaller areas of volcanic rock occur.

FIG. 3. THE GRAND FARALLON AT THE BROCAL, ELEVATION 15,000 FT., SHOWS OLD MINE OPENINGS AND DEBRIS OF FORMER OPERATIONS

The Huancavelica valley is covered with alluvium and with extensive deposits of calcareous tufa. The latter deposits are still being formed in and about the city by warm springs, the temperature of the waters of which is about 30 to 35 deg. C. One group is utilized at the public baths on the north side of the city.

The areal geology and the observations in the tunnels show clearly that the district is one of tight folding, with much slipping along bedding planes and the development of jointing. The frequence of discordant strikes and dips and the separation of the two big sandstone outcrops indicate considerable faulting. It seems, therefore, that the principal mineralized area is coincident with an area of great disturbance.

Mineralization has been widespread, and the mineralizing solutions entered and deposited their mineral content in all of the rocks of the district. The center of mineralization, however, was at the south end of the Grand Farallon, from the vicinity of which almost all the production has come.

indicates, however, that the ore followed planes of bedding and jointing in the limestone.

Of least importance have been the ore occurrences in the igneous rocks. In fact, they are of interest chiefly in fixing the period of mineralization subsequent to their intrusion.

The mineralization of the district is, consequently, an impregnation by cinnabar and its associated minerals of porous and jointed rocks in an area of igneous intrusion and tectonic disturbance. In the absence of well-defined fissures the mineralizing waters were compelled to spread over a wide area and follow less pronounced openings.

The Grand Farallon limestones are of Upper Cretaceous age. The Conglomerate limestones are younger than these. The igneous rocks are of still later age. As mineralization has taken place in all of these rocks the period of mineralization would appear to be at least as late as Tertiary. There is no necessary connection between the present warm springs and the

FIG. 4. THE BOTIJA PUNCU MINE. MINE OPENINGS IN LIMESTONE. GRAND FARALLON OUTCROPS ON RIGHT. HUANCAVELICA VALLEY IN DISTANCE

Maximum ore deposition took place within the Grand Farallon sandstone itself, in the form of an impregnation of its porous parts. The cinnabar and its associated minerals occur chiefly as a filling of the interstices between the sand grains. Where the rock is more compact the minerals have been deposited in tiny cracks in the form of stringers and veinlets.

Next in importance to the ore deposition in the sandstone was that in the limestone. The most productive deposits were in the Botija Puncu, Trinidad, and Florida mines. The Botija Puncu orebodies occurred in the Grand Farallon limestones, and seem to have been quite large (Fig. 4). Somewhat less extensive are the workings of the Trinidad and Florida mines, which are in the Conglomerate limestones. As all visible ore has been removed from the accessible portions of these workings, knowledge of its mode of occurrence depends largely on second-hand information. The nature of the workings

mineralization, but they may represent the final stage of an igneous sequence of which the volcanic rocks represent the first and the cinnabar mineralization an intermediate stage. In that event the period of mineralization was probably late Tertiary.

MERCURY ORES ASSOCIATED WITH OTHER MINERALS

The condition of the workings of the Huancavelica mines is such that practically no ore in place can be seen. It is only in the sandstone of the Brocal that some lean pillars are accessible. Here the ore is primarily an impregnation of a porous, clean sandstone, either by uniform impregnation of the rock, or along certain planes, giving the ore a banded appearance, or in veinlets and stringers. In places the cinnabar occurs alone, but it is usually associated with a black or dark bituminous substance, pyrite or marcasite, and some very fine-grained galena. Here and there is a little

realgar. No native mercury was seen, and it is said to have been very rare. Considerable quantities of native mercury are reported to have been found beneath the city in digging foundations for houses. As this may have come from various sources, it is of no particular significance in connection with the genesis of the ore deposits.

Reliable data concerning the mercury content of the ores that have been produced are impossible to secure. The average of several samples of the ore left in the mines, taken by Umlauff some years ago, was about 2 per cent mercury. Specially selected samples ran as high as 10 per cent. These figures are of little significance, however, as an aid in determining the metallic content of the ores formerly produced, or in attempting to estimate the probable content of ores that may be developed in the future. The only certain information that history affords is that this was a rich and important ore deposit in this old and geologically interesting Peruvian mercury field.

Present Operations Experimental

An inappreciable and desultory production of mercury is accomplished by small operators in outlying parts of the district. The center of interest and future promise lies in the result of the present attempt of Mr. Fernandini to get under the old Santa Barbara orebody, and thus again make this famous mine a producer. If these operations are successful, the Huancavelica district will once more become an important mercury producer. Fernandini's efforts are being centered in two major operations—one, the driving of a crosscut tunnel to get under the old oreshoot; the other, the operation of experimental furnaces at Santa Barbara with which to determine the best method of recovery of the mercury content and the limits of profitable mining and metallurgical operations.

The requisite length of the Nuevo tunnel will be at least 1,200 meters. Work on this is being pushed rapidly in two eleven-hour shifts daily, with a progress of about forty-six meters per month. Power is furnished by the hydro-electric plant, which is equipped with a Pelton wheel. A flow of three litres per second, with a fall of 140 meters, generates 106 hp. The power is stepped up to 4,800 volts for transmission to the compressors, where it is reduced to 480 volts. There are six 15-hp. compressors, all of which are run at 60-lb. pressure.

Trial Furnaces Recover Over 80 Per Cent of Mercury

Two small trial furnaces have been built at the Belen Tunnel, nine meters high and with a total charge capacity of seven tons. Ore is passed through the furnaces at the rate of 200 to 500 kilograms every three hours, and roasted at a temperature of 800 deg. C. Taquia, llama dung, is used for fuel, and the roasting requires 10 per cent more fuel than ore. The taquia costs $3 to $4 per ton. The sublimed gases are passed through a series of nine condensing chambers for the recovery of the metallic mercury. The ore for the trials is obtained from the old workings of the Brocal and averages 0.2 per cent mercury. Under the conditions of these experiments, the recovery is said to be 80 to 83 per cent. It is estimated that 0.5 per cent ore is necessary to meet expenses under the conditions that exist in the Huancavelica mercury district.

Resumption of Mining in Argentina

The mining activities of the Rosario district, Argentina, according to *Commerce Reports*, though never of prime importance, show a tendency to revive after the suspension due to the war. The Corporación Minera Famatina sent a representative, Bancroft Gore, to the United States to study the class of installation best suited to replace the water-jacket furnaces at their copper mine in Chilecito, Rioja. The company produced 733 metric tons of copper in seven months, which resulted in a financial loss, but the outlook for the future is said to be favorable and a production of 300 tons of metal per month thought possible.

The new company, known as the "Pumahuasi Industrial de Plomo," has under lease two lead properties in the Province of Jujuy, with a foundry located in Buenos Aires. The revival of the borax workings at Rosario de Lerma, in Salta, and at Santa Catalina, in Jujuy, has recently been discussed.

The beginning of a revival in building in the north is indicated by renewed activities of the marble and granite quarries and lime workings of northern Cordoba after six years of depression. By a system of co-operation the lime interests of northern Cordoba maintained themselves during the depression by pooling all orders and giving them to the concerns that most needed the business. Now that prosperity has returned, the producers prefer their independence, and this co-operative system has been discontinued.

The Japanese Iron Industry

The iron ore used in Japanese furnaces is obtained in part from domestic mines and in part from Korean, Manchurian, and Chinese mines. The iron ore produced in Japan comes mainly from the Kamaishi group of deposits in the northern part of the island of Honshu. The iron ore reserves of Japan are estimated at about sixty million tons.

The Korean iron ores used in Japan have come mainly from the surficial limonite deposits of Hoang-hai-do, about one hundred miles northwest of Seoul, which have been actively mined for ten years or more.

Chinese iron ore used in Japan has been obtained from the Tayeh mines of Hupeh Province. A part of the ore from these mines goes directly to Japan, and a part goes to the Han-Yang furnaces, near Hankow, to be manufactured into pig iron and steel products, which also go to Japan. The Han-Yeh-Ping Iron & Steel Co., which owns both the Tayeh mines and the Han-Yang furnaces, is a Chinese concern the capital of which is at present controlled largely by Japanese banking firms.

Two important Japanese-controlled iron and steel manufacturing projects are at present being developed in Manchuria.*

French Interests in Georgia

A French group, according to *The Ironmonger*, is reported to have applied to the government of the Caucasian Republic of Georgia for the concession to build a hydraulic station on the river Kur for supplying electric energy to the manganese mines at Tchiatury. The same group intends to take up the manufacture of ferromanganese on the spot.

*Harder and Eddingfield, "Political and Commercial Geology," McGraw-Hill Book Co., 1920.

A Picturesque Mining Experience—III

The Bucking Aërial Tram

BY HARRY J. WOLF
Written for *Engineering and Mining Journal*

THE mining engineer's moving picture film of memory is almost sure to contain certain vivid sections which record particularly thrilling or unusual experiences. In throwing the following picture on the screen for the amusement of my friends I recall the serious state of mind of the photographer at the time the original exposure was made, and how thankful he was soon afterward when he found that the camera was not smashed.

The picture was made in the San Juan Mountains, in Ouray County, Colorado, in the gulch leading from the Camp Bird mine to the cliffs above the mill, in the winter season early in the year 1907. It was necessary for me to go from the mine to the mill. Much snow was on the ground; more was falling; the snowslides were getting ready to run; and the trail was slippery and uninviting. What could be easier than to take passage on the wire-rope tramway that carried down the $35 mill dirt that we were producing about that time? On that tramway was one special bucket that we called the "Pullman" because it was long enough for a man to lie down in and go to sleep, if he did not care to enjoy the scenery on the way. In anticipation of a possible "hang up" on the line in blustery weather, I put on a warm sweater, and a blizzard cap provided with a visor which could be pulled down over the face, and which contained two holes to look through. On reaching the upper tram terminal I learned that the special car was at the other end of the line, so I climbed into an ordinary ore bucket, in which I sat in a cramped position as the attendant clamped it to the traction cable, and we were launched out over the snow.

The first lap of the journey was uneventful. In about a quarter of an hour I reached the curve station, where I greeted the attendant as he unclamped my bucket from the upper section of the tram and pushed it along the curved rail past the bullwheel of the lower section. With a cheerful "all's well" and "good luck to you," he clamped my carrier to the traction cable and away we went on the second lap, and here is where the fun began.

I had scarcely left the curve station when I felt a slight pulsation on the cable, which I attributed to the clamping on of the bucket of ore which followed me, and thought nothing more of it. My bucket was about fifteen feet above the ground, and I experienced a pleasant sensation skimming along over the snow and listening to the click of the bucket pulleys over the saddle that supported the track cable at each tower along the line. In a drowsy state of mind, my imagination made of my bucket a rowboat drifting over the crest of a wave each time we passed a tower, for at this point towers were rather closely spaced because they were not very high.

I was awakened from my reverie by the realization that I had felt another pulsation on the cable. The first little jerk meant nothing to me, and I had disposed of it to my satisfaction, but a second, exactly like the first, might be significant. I waited for a third, and sure enough it came, and I imagined that it was just a little heavier than the first. Now I sat up and began to take a real interest in the phenomenon. I commenced a deliberate analysis of the situation by considering first the interval of time between jerks, and I was surprised and somewhat pleased at my conclusion that the period of time elapsed between the jerks was about the same. "Ping" went the cable for the fourth time, and I was sure the interval was uniform. Each jerk was a little more pronounced than the preceding one, so that my original explanation would no longer hold water. There was no time to lose. I must investigate hurriedly, or I might not be able to solve the mystery before the trip would be over. It was also necessary to decide at once whether I should hang over the side of the bucket and drop about fifteen feet into the snow, or go ahead and

'TIS A SAD TALE, MATES

see the trip through, for the cables were rapidly rising higher above the ground. My decision was that it would be more interesting to solve the mystery than to risk breaking a leg by dropping from the tram.

The next idea that occurred to me was to find out if the distance between buckets on the line bore any relationship to the interval between pulsations on the cable. At the very next jerk I noted the position of my bucket to be about ten feet past a tower. Then I kept my eyes on the next bucket following me until it reached the same position that my bucket had occupied a few moments before, and "bing!" went the cable. The problem was now almost solved. It was evident that each bucket on the loaded side of the line was hitting something, but the obstruction was not sufficient to stop

the tram, and apparently the attention of either of the tramway attendants on the section on which I was riding had not been attracted.

My bucket was now approaching a rise, beyond which there was a basin-like depression crossed by the tramway in a few long spans between high towers. The last of these high towers was at the top of the cliff above the mill, and below it was the big rock barrier which had been built to protect the mill against a repetition of the snowslide disaster of 1906. Beyond this tower was a group of smaller towers, arranged to let the cables curve gradually over the cliff on their dip into the mill terminal.

The last jerk on the cable had been an angry one, as if to warn me that fate was out of patience with my bravado, and that I had better be less theoretical and more practical in the solution of my difficulty. I looked ahead over the long spans between me and the tall tower at the rock barrier, and it was evident that there were interesting manifestations deserving of no light consideration. The sixth bucket ahead of me reached the tall tower. It did not rise as high as the bucket coming toward me on the other cable. Apparently the track cable had jumped out of its saddle on the tall tower, and was hanging against the side of it. The bucket seemed to grab the tower for an instant and then let go, at the same time executing the most fantastic contortions as it lunged for the next tower beyond.

I viewed the show grimly, but with some consternation. The pulleys on the bucket carriage were wider than the diameter of the cable, and as the track cable was against the side of the tower the pulley would go up against the timber and try to stop; but the traction cable kept right on going and made the bucket pulley lose its grip on the tower and move along with the procession.

The fifth bucket ahead of me now had its turn, and as it lost its grip on the tower it swung from side to side through an arc of more than 180 degrees, but stayed with the track cable, thanks to the downward pull of the traction cable at this point. Next came the fourth bucket ahead of mine. I watched it execute its "shimmy" and disappear with a wiggle over the cliff. The show was becoming exciting, I began to feel warm in spite of the cold weather, and as near as I can remember, I experienced an extreme sensation of exultation somewhat comparable to that of the small boy at the circus, just as the snare drum begins to roll, and the high diver begins to lean. As the third and second buckets ahead of me did their turn, I studied their positions at the tower. The last bucket's stunt was my cue, so I stood up on the edge of my bucket, and held on to the bail, prepared to jump for the leg of the tower just before my bucket should strike. It appeared to take my bucket an interminable length of time to reach the tower, but it finally arrived, and I jumped.

An engineer is supposed to be accurate in his calculations, but my time calculation was off by a fraction of a second: at any rate the bucket and I jumped at exactly the same time, and I was shot out into space where there seemed to be nothing to grab but the air. For an instant I seemed headed for the rock pile below, and everything turned black.

A thud awakened me, and I found myself clinging to one of the legs of the tower, at the same time supported by a small temporary platform less than two feet square, which a contractor who had recently painted the towers had neglected to remove. This was the only platform of its kind on the whole line. Fate had placed it directly in my trajectory. I had fallen six feet!

Mazapil Copper Co. Operation

The Mazapil Copper Co., an English corporation with main office in Saltillo, Mexico, has a three-furnace lead smelter on the outskirts of Saltillo, southwest on the mesa. This smelter has a capacity of 300 tons of ore per day and is now smelting 200 tons daily, with a monthly output of about 720 tons of lead-silver bullion. This is shipped to England via Tampico. About 200 natives are employed and 10 foreigners. The peon wage is 1.75 pesos per day.

The same company has a larger smelter at Concepcion del Oro, in northeastern Zacatecas. This smelter handles copper ore, having an equipment of four furnaces with blowers and a battery of six boilers. It has a capacity of 25,000 tons of ore per month and is now smelting about 15,000 tons, the present monthly output of copper matte being about 350 tons. This smelter employs 500 natives and 30 foreigners. The peon wage is 1.75 pesos per day.

In the region of Concepcion del Oro are the following mines belonging to the Mazapil Copper Co.: Aranzazu, producing 15,000 tons of copper ore per month and employing 1,500 men; San Eligio, producing 4,000 tons of lead-silver ore per month and employing 550 men, and Cata Arroyo, producing 4,000 tons of sulphur and iron flux and employing 250 men. The Mazapil Copper Co. is providing employment to approximately 3,000 men.

Manganese Industry in Japan

The expansion of the Japanese shipbuilding industry and other iron and steel manufacturing industries during the war brought about a greatly increased demand for manganese, according to Vice Consul H. C. Goodier, as is shown by the fact that 125,683,952 lb., valued at $973,153, was produced in 1918, a gain of 85,417,067 lb. in production over 1913. Of the 1918 output, Kyoto produced 24,422,317 lb., valued at $185,794; Hokkaido, 18,408,075 lb., valued at $143,060; and the remainder was produced by Gifu, Aomori, Oita, Tochigi, Nagano, and Shizuoka prefectures. No statistics are available for 1919, but it is estimated the production was small, owing to the marked decrease in domestic demand that has followed the cessation of hostilities.

In 1918, Japan proper consumed 106,235,000 lb. of manganese, two-thirds of which was used in the manufacture of iron and steel and the remainder for smelting and other purposes. It is believed the consumption in 1919 was not more than a third or a half of the 1918 amount.

Japan in 1918 imported ferromanganese to the amount of 1,697,280 lb., valued at $203,452, of which Australia furnished 1,132,800 lb., valued at $141,139, and Great Britain 564,480 lb., valued at $62,313. The principal countries to which Japanese manganese is exported are the United States, Great Britain, France, and China. In 1918 Japan's exports to these countries aggregated 5,229,864 lb., valued at $176,120, and in 1919 the exports amounted to 6,158,932, having a total value of $237,365.

Government Officials Influential in Mining

Frank J. Katz

In Charge of Mineral Statistics for the Census Bureau

TEN years ago the census reports on the mineral industries were done so poorly that their value frequently has been called into question. In an effort to improve on past performance arrangements were made for close co-operation with the Geological Survey and the Bureau of Mines during the taking of the present census. With the approval of the Bureau of Mines, F. J. Katz, a geologist long connected with the mineral resources division of the Survey, was appointed by the Superintendent of the Census to direct the gathering of the mineral statistics. He is now actively engaged in tabulating the vast amount of information which has been collected. The work has gone far enough to determine that 47 per cent of all mining and quarrying operations have as their object the securing of oil or gas. The remainder of such operations is divided as follows: Coal, 18 per cent; gold, silver, lead, copper and zinc, 21 per cent; quarries, 11 per cent; iron, 2 per cent; all others, 1 per cent. Mr. Katz has warned against a possible disappointment in the work of this census, owing to inadequacy of funds and to the policy of continuing tables so that they will be comparable with those of previous censuses.

FRANK J. KATZ

Mr. Katz was born in New York City. His early education, however, was obtained in the public schools of Milwaukee. After being graduated from the Milwaukee high school he entered the University of Wisconsin, where he completed the regular course in 1905. He did a year's post-graduate work at the institution and took further post-graduate work at the University of Chicago.

When Mr. Katz entered the University of Wisconsin he expected to do only a limited amount of work there, preparatory to entering a school specializing in metallurgy. Prof. C. K. Leith and the late Prof. C. R. Van Hise made the geology classes so interesting, however, that he gave up his idea of being a metallurgist and made geology his specialty. His first work was exploration of iron lands for a private company. Even then he devoted a portion of his time to the U. S. Geological Survey. In 1907 he abandoned private work and began giving his entire time to the Survey. He spent four years in the division of Alaskan mineral resources and later did general geologic field work, chiefly in New England. In 1912 he was assigned to the division of mineral resources, where he has specialized in abrasives, feldspar and silica. During the early war period he did emergency work on manganese in Virginia. With the formation of the Joint Information Board, early in 1918, he was assigned exclusively to its work. One of Mr. Katz's principal activities during the war was as an expert on the abrasive industry. This important industry was continually under investigation by the War Industries Board, the Bureau of Mines and the War Trade Board. The various kinds of abrasives of varying hardness, which are used in the finishing of all metal, were indispensable war necessities, and the minerals used as natural abrasives were produced both in the United States and elsewhere. In the vexing problems of securing a sufficient supply, coupled with economy of effort and conservation of shipping space, Mr. Katz's special knowledge made him an invaluable stabilizer of half-cock impulses; and at times also he lent his knowledge to preventing raids on the Treasury by politicians who seized the war as a cover for attemping to push through schemes to promote unnecessary abrasive mining in their home districts. Prior to his census assignment Mr. Katz had been promoted to the post of administrative assistant to the chief of the mineral resources division.

Those who know Mr. Katz best agree that the conferences among the Census Bureau, the Geological Survey, and the Bureau of Mines, which resulted in his appointment, picked a good man. The official in charge of mineral statistics for the last census was, according to tradition, the secretary of a cloakmakers' union; at any rate, some of the statistics were such that they were very much criticised by experts in the mining industry. However much Mr. Katz may be hampered by precedent, the results of his work are bound to be important in giving a more correct picture of the industry than was presented before.

HANDY KNOWLEDGE

Prolonging the Life of Elevator Belts

BY DONALD M. LIDDELL

Written for *Engineering and Mining Journal*

The life of the elevator belts at the Butte-Kansas mill, near Waco, Mo., has been more than doubled by putting strips of belting between the cups and the belt.

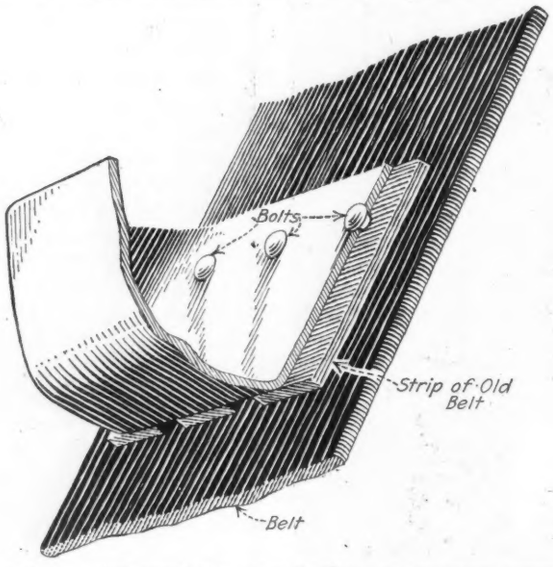


FIG. 1. METHOD OF ATTACHING ELEVATOR CUPS

Old belting is cut into strips about 1¾ in. broad and 5 in. long, and a hole punched at one end of the strip through which the cup bolt passes. Three or four

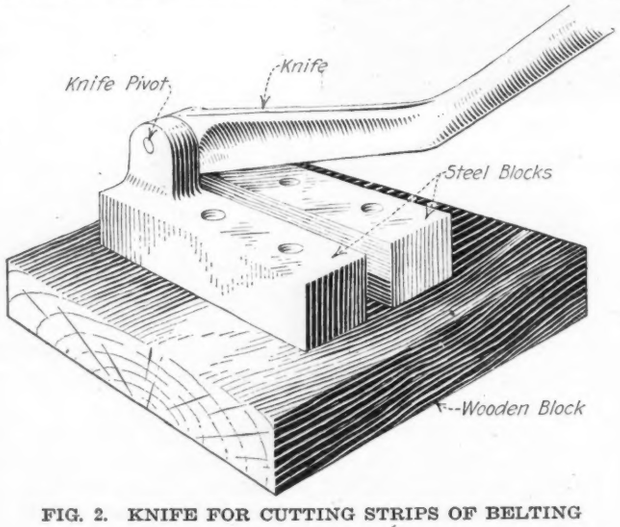


FIG. 2. KNIFE FOR CUTTING STRIPS OF BELTING

of these, depending on the number of cup bolts, are then used behind each cup. With these strips of old belt behind the cup the belt does not crack along the line of the upper cup edge. When the belt does begin to show wear, the cups are all set in new positions. Sometimes the cups can be reset three times.

A large knife (Fig. 2) has been made, with a lever handle, especially for cutting the old belt into strips. The knife blade comes down between the steel blocks, shown in the cut, which must be set not much further apart than the thickness of the knife blade.

The experiment has also been tried of crowning some of the elevator pulleys with old belting, which apparently saves both pulleys and elevator belts.

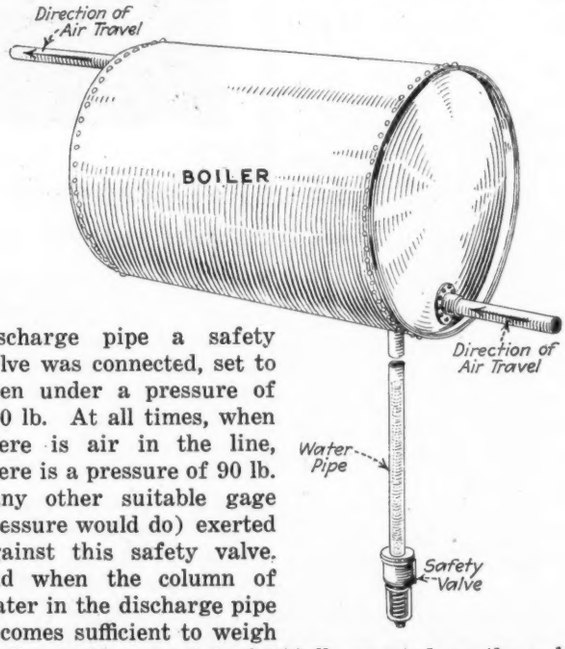
Water in Compressed Air

BY G. L. SCHMUTZ

Written for *Engineering and Mining Journal*

The presence of water in compressed air is one of the principal causes of machine-drill repairs, owing to the fact that water in the air, in a few strokes of the machine, replaces the oil, leaving the drill to run without lubrication until the machine is again oiled; but even then, it is only a short time until the machine is again divested of its lubrication. This is a source of loss of time as well as money, and the obvious solution is to remove the water from the compressed air.

One method which has come to my attention consists in incorporating an old steam dome, or boiler, into the main air line leading away from the compressor, at a sufficient distance from the compressor to permit the precipitation of the humidity in the air. The air line enters the bottom of the boiler and passes out through the top at the other end, the boiler being used as a catch basin for the precipitated water. To dispose of this water automatically a 2-in. pipe leads away from the bottom of the boiler and down an old winze, or down the sides of a hill. On the end of this water-



discharge pipe a safety valve was connected, set to open under a pressure of 100 lb. At all times, when there is air in the line, there is a pressure of 90 lb. (any other suitable gage pressure would do) exerted against this safety valve. and when the column of water in the discharge pipe becomes sufficient to weigh 10 lb., making a total of 100 lb. exerted on the valve, it opens, thereby automatically releasing the water from the air line. Operation and maintenance involve no expense.

By The Way

Early Smelting in Nevada City

"In 1851 the people of Nevada City were led widely astray to their great cost and disgust by an individual, who called himself Dr. Rogers," runs a passage in Hittel's "History of California." "It cannot be affirmed that he was a fraud in the same sense that Captain Slater, of Downieville, was; he probably deceived himself as well as others; but the story of the excitement of the people of Nevada City at the time referred to, and the wild-goose chase that Rogers led them, illustrates another phase of early mining days, which was often exhibited. The discoveries there and in that neighborhood of extensive auriferous quartz veins attracted much attention to the nature of siliceous rock and the possibility of extracting gold from it. Dr. Rogers professed to know all about the subject; and as he made great pretensions and talked learnedly and glibly, almost everybody believed in him. He said that quartz was of a porous or cellular structure; but that the interstices between the crystals were not large enough in the ordinary state and at the common temperature to allow the particles of gold to drop out. By the expansion of heat, however, the pores would open and the metal have free egress either in form of minute grains or, if the heat was sufficient, as a melted current. All that was needed was the appliances for heating and giving it a complete shaking up. To the Nevada City people this looked reasonable enough; and there was no difficulty whatever in raising all the money needed, while everybody who had the opportunity of contributing reveled in the idea of soon rolling in gold. A capacious furnace and large chimney were built at great expense and a mammoth wheel erected on Deer Creek about a mile below the town. Wood, coal and ore in immense quantities having been brought to the place, a large iron reservoir at the bottom of the furnace was filled with water to receive and cool the precious metal as it loosened and fell or flowed from the rock. Everything being ready, the furnace was filled with alternate layers of fuel and auriferous quartz; the fire was kindled; and, as the mass burned down and lowered in the furnace, more and more wood and rock were added at the top. The great man, in whose capacious brain the whole process lay prefigured and who was receiving a salary commensurate with the magnitude of the undertaking, rode up occasionally, and with the air of a commander-in-chief gave orders, which were obsequiously obeyed, while the expectant millionaires stood around, eager for a sight of the first fruits of the princely harvest they were to reap. At length, after tons of rock had passed through the fiery ordeal and it was supposed that the iron reservoir must be about running over, a suggestion was made that it would be well to take out a few millions so as to give place for more. The cinders and ashes were accordingly scraped away and the cauldron was hauled forth; but it was as void of gold as when originally put in position. Not a pore of the burnt quartz had opened, or, if it had, not a particle of the rebellious gold had come out of it. The entire scheme, which had been based upon ignorance and presumption, instead of knowledge or experience, was a complete failure; and the prospective Midases reaped no harvest except the consciousness of having long ears. Rogers himself left in disgust; the quartz was pronounced a humbug, and property in Nevada City, which had gone up in the excitement, fell to a lower figure than it was before."

Versatility

An artesian flow of hot water was recently encountered in the Wheeler Oil Syndicate's well at Stillwater, Nev., which is said to have spouted to a height of 100 ft. and to have shown "unmistakable signs of oil." "The well is versatile," according to a local published account, which goes on to say:

> Not alone has hot water come from several stratas, but silver and gold were found at the 140-ft. level. This paystreak was found above the first flow of hot water, and it is asserted that a vein of sulphide ore was penetrated that is from four to five feet in thickness. The assayer made a determination of values of the samples released by the drill and found that they contained 7.29 oz. silver and $1.20 in gold—a total of $8.49. Three days later the drill released a small seepage of oil, which was followed by a vast and constant flow of hot water from the stratum reached Saturday. It must be seen that the Wheeler Oil Syndicate is at work exploring a wonderland that has never been understood, yet gives promise of yielding both metal and oil in paying quantities.

Some of the holes being drilled on the Comstock at present, which may not be dignified by being called "wells," will no doubt show just as much gold and silver and even more hot water, unless the Comstock has gone dry below as well as on top. And, perhaps, as a sweetener, there will be a dash or two of oil, to say nothing of acid and other things, the recital of which would make this sound like a recipe for something or other. But this is hardly versatility.

How To Be Poetical Though Practical

A correspondent sends us one of his mining reports, from which we quote an excerpt:

> Those snowfields and glaciers, those raging torrents and gentle streams and rolling rivers have come from afar from the sun-kissed waters of the Pacific, and they have been borne here on the wings of the wind and deposited on the hills and mountains to gladden the heart of man and give life and joy to the world. Their task being done they return to the great ocean whence they came.
>
> Keats, or Francis Thompson, or some other of the mystic poets, must have had this vision of the moving waters in mind when he wrote:
>
> "Henceforth live as becometh the God's elect,
> And though thy sins be countless as the seashore sands,
> Thy life as loathsome as the sulphurous pit,
> All shall be forgiven and forgot and thou, thyself,
> In time shall be dissolved,
> In the great ocean of God's unfathomable love."
>
> Looking down the Valley of the Sheep one sees two lofty and rugged ranges towering over it on the north and south. Torrents and slides and rivulets have worn deep in the sides of these mountains, and in the gorges and gulches, woods and groves are plentiful, save where avalanches and rock slides have played havoc. The ridge on the south is a formation of sandstone and shales in alternate layers, and in this formation are some thirty or forty layers or seams of coal. The coal seams dip to the south and west at an angle of 70 deg., being thus nearly vertical, and they vary from a few inches to forty or fifty feet wide.

What Color Is a Cape?

"A deputation representing the Cape-coloured Mine Workers waited on the Chamber in April and presented a petition setting out certain grievances."—Transvaal Chamber of Mines, Report of the Executive Committee, June 19, 1920.

CONSULTATION

Dollar Silver Payments

"In the *Engineering and Mining Journal*, issue of July 24, Vol. 110, p. 147, the first page, and also on page 188, you make some statements upon which I should like to have a little advice.

"1. Page 147, article entitled 'The Fixed Price of Silver': 'The silver so bought will be minted into coins or placed in the Treasury vaults as a reserve against the silver certificates outstanding or to be issued.' The 'outstanding' leaves me with the impression that our Government has issued silver certificates certifying that the silver has been deposited in the U. S. Treasury without its actually having been done so. I beg to inquire whether or not such is the fact.

"2. Page 188, 'On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States.' I beg to inquire whether or not there is any known method of determining whether the silver delivered has been mined, smelted, or refined in the United States or some other country. If it can be purchased cheaper in some other country, is not there considerable temptation to introduce some of this silver in that mined, smelted and refined in the United States?

"As far as I can see, the only thing which has maintained our silver dollar on a par with the gold dollar is that it was redeemable in gold, and its value consisted of the metal in it and the guarantee of the Government behind it. I have been told, and have no reason to question it, that on the Mexican frontier people have taken our United States silver dollar into Mexico, purchased a dollar's worth of goods there, and brought back a Mexican silver dollar having as much silver in it as ours. It, however, was different in this respect from ours: it was worth nothing more than the silver in it, whereas ours, upon being taken to the United States Treasury, could be exchanged for a gold dollar, with which you could buy twice as much silver as there was in our silver dollar, and take it to Mexico and get it coined into two silver dollars.

"3. I beg to inquire in what form is the payment made for silver which the Government purchased at $1 an ounce. Is it in silver certificate, silver dollar, or gold dollar? It is my understanding that in purchasing gold, it is paid for in gold or the free coinage."

1. We cannot answer for the Treasury Department, but believe that the Goverment has no silver certificates outstanding which are not fully protected by a metallic silver reserve in the Treasury vaults, particularly as a large quantity of silver remained from the stocks drawn upon during the Pittman Act. Silver certificates were retired during 1918 and an equivalent amount of silver bullion was issued in exchange.

2. Although there may be considerable temptation to perpetrate fraud upon the United States Government by disposing of foreign silver in introducing it into silver bullion of domestic origin, the authorities insist upon affidavits which will unquestionably indicate the origin, place of smelting, and refining of the metal. A few months ago, as the purchase provisions of the Pittman Act were put into effect, considerable difficulty was experienced by the smelters—particularly the ones smelting foreign ore in conjunction with domestic supplies—in segregating silver as regards origin. However, owing to an admirable spirit of co-operation between the Government officials and smelter operatives, these difficulties were gradually straightened out, chiefly through a modification of the original affidavits required. It is not so easy to palm off foreign silver as may be supposed, and no doubt there are just as stringent penalties covering this especial variety of fraud as any other brand. Besides, it is indirectly possible to obtain a check on the domestic production from past and present performances.

3. As to the form in which payment is made for silver purchased by the Government, we presume the settlement is usually concluded by a check or draft upon the Treasurer of the United States. This in turn can be exchanged into most any form of currency desired, with the great probability that Federal Reserve notes will be the currency ordinarily acquired—or at any rate negotiable paper. But the form at the present time has little if any significance, as the country is in a sound financial condition and all forms ultimately revert to a gold basis, which is the real foundation of settlement. For each ounce of bullion sold to the Government, one dollar in gold, or its equivalent, is paid. When the Government sold its silver at one dollar an ounce it also received payment on the same basis.

An Illogical Mineral Exploitation Agreement

"We have received an inquiry from one of our clients who has found traces of valuable minerals on some land in Tennessee and would like to get in touch with a mining company or promoter who would undertake to sink a shaft and make the necessary investigations to ascertain the value and desirability of extending operations. This work of investigation would have to be done by the company or promoters at their own expense, with the assurance, of course, that they may lease the ground at reasonable terms, should valuable mineral deposits be discovered. We would greatly appreciate your sending us the name or names of any individuals or organizations which you know of that would be likely to undertake work of this nature."

It is our impression that considerable difficulty would be found in obtaining a mining company or promoter to undertake the development of this property under the terms and conditions that you outline. In the first place, you say your client has only discovered traces of valuable minerals on his land. Surely, this alone is not enough to justify the sinking of a shaft and the expenditure of money in the hope that valuable and commercial deposits can be found at depth. Modern mining is not done upon this principle. Furthermore, you say that your client would require the promoting company to assume the expense of sinking the shaft and performing the development work, with the assurance that it may subsequently lease the ground at reasonable terms without specifying the reasonable terms. This is a rather loose and lop-sided proposition, and your client can consider himself fortunate if he secures any one to do this work on such terms, especially considering that no valuable ore has been found. The advertising pages of the *Engineering and Mining Journal* contain the names of companies which develop and exploit mineral deposits.

THE PETROLEUM INDUSTRY

Petroleum in Colombia

Proved Territory Limited to Three Square Miles, But Oil-Bearing Area Is Large—Development Expensive, Though Cheap Transportation of Product Is Possible—Tropical Petroleum Co. the Only Active Producer

BY ARTHUR H. REDFIELD*

THE oil-bearing formations of Colombia extend over about 34,000 square miles, of which only 618 square miles are believed to contain oil in commercial quantity, and only three square miles have been proved by drilling. The region may be divided into two principal districts, the Caribbean and the Pacific. The Caribbean district may be subdivided into the Caribbean fields, the Magdalena-Santander field, and the Tolima field.

Oil is now produced in the Magdalena-Santander field, but it has been found also in the Caribbean field, which, however, has not been commercially developed. The Tolima field and the Pacific district have been explored only.

The petroleum found in Colombia ranges from a heavy asphaltic oil to a light paraffine-base oil of 41 deg. Bé. (sp.gr. 0.8187).

THE CARIBBEAN FIELD

The Caribbean field extends from Hacha River, on the western edge of the Goajira Peninsula, southwestward along the Caribbean coast to the Gulf of Urabá (Darien) and inland to include the Tubará and Turbaco gas pools, up Magdalena River to a point thirty miles south of Chima and Mompos, and up Atrato River for ninety miles. It is about 300 miles long by 50 miles broad. In its 15,000 square miles are probably 300 square miles of productive territory, of which only one square mile has been proved by the drill.

The oil-bearing rocks of the Caribbean field are lower Tertiary (probably Oligocene). They are coal-bearing and consist of dark shales containing sandstones. Oil occurs in the sandstones and in the joints of the shales. The surface formations are either Miocene or Pliocene. The Miocene rocks of the coast are at least 8,000 ft. thick.

The beds in the region are broadly to sharply folded and are at places faulted. Nearly all the surface indications of oil are found in anticlinal areas. Most of the oil seeps occur in shattered fault zones or in the crushed cores of closely folded anticlines.

In weight, the petroleum of the Caribbean district ranges from 16 deg. to 41 deg. Bé. (sp.gr. 0.9587 to 0.8187), most of it being between 20 deg. and 30 deg. Bé. (sp.gr. 0.9333 to 0.9750).

A paraffine-base oil of good quality is found east of Sinu River. Its specific gravity is 0.858, its viscosity 0.98, and its flash point 101 deg. F. On analysis it gives: Naphtha, 2.92 per cent; kerosene, 31; lubricating oils, 30; paraffine, 3; and residuum, 27.08 per cent.

*Excerpt from a paper prepared by the Foreign Minerals Section of the U. S. Geological Survey.

Analyses of Colombian oils from the region of the Gulf of Urabá by the Engler method gave the following results:

ANALYSES OF MINERAL OILS FROM THE GULF OF URABÁ

Fractions	Percentages Arboletes	Pinar del Rio
Up to 150 deg. C. (benzine)	0	6
150 deg. to 300 deg. C. (kerosene)	25	64
Above 300 deg. C. (lubricating oils)	64	24
Carbonized residuum	11	6
	100	100

The oil from Arboletes is thick, reddish-brown by transmitted light, and dark green in reflected light. Its specific gravity is 0.9634; its flash point is 134 deg. C.; its point of combustion 149 deg. C. The residuum contains paraffine and 0.01 per cent of ash. It could be used in making lubricating oils.

The sample from Pinar del Rio is pure red in transmitted light and light green by reflected light. Its residuum contains very little paraffine. This can be used in making gasoline, kerosene, and lubricating oils.

Oil scum of good quality is found on the surface of the Hacha and other small Caribbean rivers. Sulphur springs occur at Usiacarí, two miles southwest of Tubará, and seepages of oil are numerous in this region, especially near Tubará and near Arboletes. Indications of oil have been reported near Calamar, on Magdalena River; near Baranoa; south of Salgar, on the Puerto Colombia Ry.; and in the regions of Galera Zamba and Savana Larga. Sir Boverton Redwood reports no less than forty oil springs at places one to three miles from the Gulf of Darien. One seepage ten miles south of Punta Arenas and four miles east of the Gulf of Urabá yields seven barrels a day of a paraffine-base oil of 41 deg. Bé. (sp.gr. 0.8187). This high-grade oil is used in lamps by the natives.

HISTORY OF DEVELOPMENT

The first well drilled in Colombia for petroleum was sunk in 1909 at Tubará, six miles from Puerto Colombia. The Atlantic Oil Co., composed of capitalists from Toronto, Canada, after two unsuccessful tests, struck a high-grade paraffine-base oil at a depth between 700 and 800 ft. This well is still producing about a barrel a day, which is refined on the ground for use as automobile fuel. Gas was encountered in large quantities and at high pressure, and is used on the property as fuel. In 1912 the contract rights were transferred to the Three Seas Petroleum Co., of Chicago, which controls under lease about 400,000 acres in the vicinity and which purposes to continue operations.

Soon after work was begun on the Tubará lands a

well was drilled at Turbaco, ten miles from Cartagena, by Diego Martínez & Co., of Cartagena, to a depth of 2,000 ft. Showings of oil and gas were obtained, but work was not continued in that vicinity. The oil encountered was reported to be high in naphtha.

The same Diego Martínez, after having "denounced" (claimed) certain claims in the Lorica district, on Sinu River, in 1909 or 1910, contracted with the Standard Oil Co. of New York for their exploitation. This company sent down an outfit and began drilling in 1914. Three wells were drilled, in which showings of oil were encountered, but because of mechanical difficulties no oil was produced commercially, and work was abandoned in 1915. Diego Martínez & Co. are now operating in the region of the Gulf of Urabá.

In 1912 or 1913 William Plotz, of California, drilled to a depth of about 2,000 ft. at Baranoa, fifteen miles from Barranquilla, without result.

Magdalena-Santander Field

The Magdalena-Santander field includes the southern part of the Department of Magdalena, the Department of Santander, and the western edge of the Department of Boyacá, extending from Magdalena River to the eastern Cordilleras. It has an area of 10,000 square miles, of which only 200 square miles are believed to contain oil in commercial quantities. Only one square mile near Pamplona, and a similarly small area thirty-five miles from Barranca Bermeja, have been proved by drilling.

The petroleum is found in Cretaceous limestones and sandstone and in coal-bearing lower Tertiary (probably Oligocene) beds. In the Magdalena Valley and the eastern Cordilleras the oil is found in Cretaceous formations. The structural features in this district that are most favorable to the accumulation of petroleum in commercial quantities are long, well-defined anticlines (in places overturned) and fault zones in Cretaceous rocks.

The structure in the lower Magdalena Valley is of the fault-block mountain type, with downthrow on the west. The major structure is complicated by close folds, the axes of which lie parallel to the trend of the Andean ranges, and by more open cross folds. The lands where the petroliferous beds may be tested by the drill are confined to a narrow belt at the foot of the two mountain ranges. In the Department of Santander, on the east slope of the Andes, the structure is that of an asymmetric anticline.

Petroleum seepages occur along Magdalena River as far south as Girardot and along the Magdalena flank to the eastern Cordilleras from a point south of Girardot northward to Bucaramanga, in Santander. The strata are sharply folded and in many places fractured. Indications of oil are reported near Pamplona, on the Venezuelan boundary; near La Gloria, on Magdalena River; at Simiti, in the Department of Bolivar; in the valley of the Cesar River above Lake Zapatosa; in the valley of Lebrija River; near Ocana; on Carare River; near Zapatoca and Sogamosa River; near Bucaramanga; south of Honda; and near Chocontá, Ubaté, Chiquinquirá, and Tunja.

Petroleum is produced in Colombia only in the Magdalena-Santander field, on the celebrated De Mares concession. This concession, as originally granted in 1905, comprised 1,300,000 acres in the Department of Santander. It extended from the mouth of Sogamosa River up Magdalena River to the mouth of Carare River, up Carare River to the foot of the eastern Cordillera, thence along the foot of this range to Sogamosa River, and down that stream to its confluence with the Magdalena. The original concessionaire, Señor Roberto de Mares, enlisted the aid of a group of Pittsburgh capitalists, who organized the Tropical Oil Co., with a capital of $50,000,000, to exploit the concession. This company has drilled three deep wells at Infantas, which are said to produce daily 6,000 to 8,000 bbl. of an asphaltic oil testing from 35.5 deg. to 40 deg. Bé. This quantity is enough to supply all Colombia and leave a surplus for export. A 6-in. pipe line is being built to Barranca Bermeja, where a small refinery is to be erected. It is expected that the river steamers will soon burn native oil instead of wood, their present fuel. A railroad and a tractor road from Barranca Bermeja to the wells are among the projects under way.

It is reported that the International Petroleum Co., a subsidiary of the Imperial Oil Co. (Ltd.), which in turn is controlled by the Standard Oil Co. of New Jersey, has acquired control of the Tropical Oil Co.

Carib Syndicate Concession

The Barco concession, granted in 1905 to a citizen of Colombia, Virgilio Barco, includes 1,300,000 acres adjoining the Venezuelan frontier in the Department of Santander del Norte. The Carib Syndicate, of New York, was organized in 1916 to develop this concession, and formed, with the Cities Service Co., of New York (a subsidiary of H. L. Doherty & Co.), the Colombian Petroleum Co., in which the title to the concession was vested and in which the Carib Syndicate held 25 per cent of the stock and the Doherty interests the remaining 75 per cent. Drilling was started in the fall of 1919 but was necessarily slow, as all supplies had to be brought from the United States by way of Lake Maracaibo and Catatumbo River.

The petroleum of this concession is said to be an amber-colored oil of high grade, which seeps at the rate of 25 bbl. a day. It was reported in March, 1920, that the Carib Syndicate, of New York, had acquired from the Equatorial Oil Co. a block of 250,000 acres in the Honda district, adjoining the holdings of the Tropical Oil Co. The lands acquired lie on both sides of Sogamosa River, extending along that stream for about thirty miles. Practically all this area was acquired in fee simple, the fee including the oil rights subject to nominal tax by the Colombian government.

The Granada Oil Co. (formerly known as the Magdalena River & Coast Co.), of New York, has under long-term lease an area of 125,000 acres on Magdalena River near Ocano.

Tolima Field

The Tolima field consists of the upper basin of the Magdalena, including the departments of Cundinamarca and Tolima and the edge of the Llanos of San Martin and Casanare. Of a total area of 7,000 square miles in this region only 100 square miles are believed to be productive, and no part of it has been proved by the drill. The Tolima field consists principally of an elevated basin around Bogotá, which is surrounded by Carboniferous coal measures except where Magdalena River issues from the upland region.

The structure of the upper Magdalena Valley is of the fault-block mountain type, with the downthrow on the west, and is masked by late Tertiary tuffs or pyroclastics. Seepages of thick black asphaltic oil of 14 deg. Bé. and amber oil of 18 deg. Bé. are found along lines of faulting where black carbonaceous limestones and

shales of the Cretaceous system are brought to or nearly to the surface. Seepages of migratory oil are found in rocks of later age.

Six natural oil springs issue from fissures in sandstone near the village of Purificación, seventy miles south of Honda and three miles from Magdalena River. The oil is rich in lubricants and kerosene. Oil of a gravity of 22 deg. Bé. exudes from sandstones in the Plain of Medina, nine miles from Upia River, at the rate of two bbl. a minute. Seeps are abundant at the edge of the Plains of San Martin and Casanare, on the east side of the Andes. At a point 140 miles north of Nevea samples of an oil from 31 deg. to 38 deg. Bé. (sp.gr. 0.8696 to 0.8333), with a paraffine base, were collected. A seepage was found at Carmen, fourteen miles by road from Girardot, on Magdalena River. Oil taken from seeps in this district is used for lubricating the journals of car wheels on the Sabana railroad and on the railroad from Girardot to Bogotá.

Asphalt Deposits

Asphalt is found south of Ambalema; west and southwest of Honda; west of Magdalena River, especially near Saldama River; and at Natagaima, Yaguará, and Larida, in the Department of Tolima. Asphalt containing 99.5 per cent bitumen has been mined at Chaparral since 1903. Asphalt from Boyacá has been used to pave the streets of Bogotá. Gas has been noted at several places in the elevated plain of Bogotá.

The Pacific District

The Pacific district includes a belt in the Department of Cauca that extends sixty to seventy miles along the Pacific Coast from Buenaventura to Baudó River and thence inland to Atrato River at Quibdo and southward to Cali. It has an area of 1,800 square miles, of which eighteen square miles may be productive. None of this area has been proved.

The petroleum of Baudó River is connected with the "coal series" (lower Tertiary, probably Oligocene), which is perhaps a continuation of the petroliferous formation of the Caribbean coastal belt. The predominant rocks are shales that have been sharply folded. This oil ranges in gravity from 31 deg. to 37 deg. Bé. (sp.gr. between 0.8696 and 0.8383).

Oil has been seen floating on Andagusta River. A heavy pretroleum has been found east of Quidbo, where the Quidbo-Medellin trail crosses Tutendnendo River. Other indications of oil occur along Baudó River, twenty miles from Santa Rosa, four miles north of Porce River, and south of Nechi River.

Colombia has certain geographic advantages as an oil-producing country. The Caribbean petroleum district is not more than 200 miles from the Panama Canal, where large quantities of fuel oil may be used. Magdalena River, if dredged and improved, would afford cheap transportation by water for the oil refined at Barranca Bermeja. The oil of Santander del Norte might be shipped on Catatumbo River.

Difficulties of Operation

Mineral oils have not been exploited in Colombia principally for three reasons: (1) Transportation is difficult and has been confined chiefly to the coast and to the immediate basins of the large rivers; (2) the local geology presents peculiar features, which have not all been adequately studied; and (3) certain practical difficulties of operation have not been fully overcome.

The cost of the preliminary work by the geologists in a country where the mode of travel and transportation are still in a primitive state is great. The work of prospecting requires heavy machinery, which is difficult and expensive to transport. Three hundred tons of machinery is required for a single well, and if the well has to be abandoned the machinery will be practically a dead loss, owing to the difficulty and expense of moving it. All experts, whether technologists or skilled workmen, must be brought into the country at high salaries or wages, and much of the food, especially canned goods, needed for the working force must be shipped from the United States. Practically all wood used in constructing buildings or bridges must be imported, for the native woods are unsuitable for this use. For lack of detailed geologic knowledge of the ground, the driller may not be able to determine the type of drill rig, rotary or standard, that is best adapted to the formations; and consequent accidents to the drilling apparatus may cause the loss of the well. Finally, after wells have been drilled, oil may not be found in sufficient quantities to warrant the construction of roads, bridges, pipe lines, tanks, refineries, and pumps. The cost in Colombia of laying a pipe line, which is considered the cheapest method of transporting the oil, was estimated in 1917 at $20,000 to $30,000 a mile.

Companies Participating in Development

The American companies that were working or prospecting in Colombia in the latter part of 1919 included the Tropical Oil Co., of Pittsburgh, exploiters of the De Mares concession and the only active producers of petroleum in Colombia; the Colombian Petroleum Co., of New York (in which the Doherty interests hold 75 per cent of the stock and the Carib Syndicate 25 per cent), owners of the Barco concession; the Three Seas Petroleum Co., of Chicago, which is operating at Tubará, near Puerto Colombia; the Bradford-Colombia Oil Co., of Bradford, Pa.; the South American Gulf Oil Co., of Pittsburgh; the Midco Co., of Tulsa, Okla.; the Island Oil & Transport Co., of New York; Guffey & Gillespie, of Pittsburgh, who have purchased 1,250,000 acres adjoining the De Mares concession; the Ohio Cities Gas Co., of Columbus, Ohio; the Sinclair Gulf Oil Corporation, of New York; the Carter Oil Co.; the Prudential Oil Co.; the International Petroleum Corporation, which is reported to have recently acquired control of the Tropical Oil Co.; the Magdalena Oil Corporation; the Granada Oil Corporation; the Caribbean Petroleum Co. (a subsidiary of the Barber Asphalt Co., of Philadelphia); the Emerald Oil Co., (A. J. Diescher); and the Transcontinental Oil Co., which is under the control of Benedum-Trees interests.

British Capital Also Interested

British capital is represented by the Lobitos Oil Co., of Peru; the Royal Dutch-Shell group; the Anglo-Persian Oil Co.; Balfour, Williamson & Co., of London; the Alvez group, of London; and the Jenks group, of London, all of whom are reported to be active in making contracts but about whose activities little definite information has been obtained.

Colombian capital has indicated its intention of participating in the development of the petroleum resources of the country by the formation of the National Petroleum Co., of Bogotá, announced Feb. 9, 1920. No details of the capitalization or activities of the company have been made public.

NEWS FROM THE OIL FIELDS

26,000-Bbl. Well a Record in Brazoria County, Tex.

From Our Special Correspondent

At West Columbia, Brazoria County, the Texas Co.'s No. 1 Abrams well is still flowing at the rate of 26,000 bbl. daily with the drill stem and bit still in the hole. The previous record producing well in this field is said to have made 1,000,000 bbl. in thirteen months. This record is practically surpassed already, with little if any abatement in flow.

The Texas Co.'s No. 16 Koehler well at Humble, Harris County, was worked over and deepened to 3,178 ft. recently, and it responded by flowing 5,000 bbl. per day.

An opinion has been given to the State Land Commissioner, J. T. Robinson, by the Attorney-General's office that any person leasing state land for oil or gas production purposes must pay the state $2 an acre per year in advance for such leased land.

It is reported that the well of the Capitol Petroleum Co., near Weatherford, Parker County, came in flowing a strong head of gas estimated at 500,000 cu.ft. The gas became ignited.

The test well on the Baggett lease, two miles south of Gunsight, Stephens County, was completed at 3,335 ft. after penetrating a considerable footage of oil-bearing limestone. Nitroglycerine was lowered into the well to shoot it, but when the casing was raised considerable ground caved upon the charge, and the well will not be disturbed for a few days.

Short Supply of Casing Will Limit Wyoming Drilling

From Our Special Correspondent

A meeting was held in Denver on Aug. 19 and 20 by representatives of several of the larger oil-producing companies of Wyoming, particularly those of the Salt Creek field, to discuss the problem of the shortage of casing caused by insufficient transportation facilities. It was resolved that it would be better to limit drilling, if necessary, rather than pay premiums or bonuses for casing or any other supplies above the usual list prices plus freight charges. The Salt Creek operators also agreed to limit the spacing of wells to one per acre, to protect the future production of the field.

A number of large oil-well supply houses have opened or are opening offices in Denver as a result of the extension of the Wyoming oil fields to the southern part of that state, and the large amount of prospecting which is under way or planned in Colorado. James Purcell, formerly with the Texas Co., has been appointed manager of the Denver office of the Continental Supply Co., with offices in the First National Bank Building. The National Supply Co. has opened offices in the Gas and Electric Building, with J. O. Ingram in charge. His supervision still extends over the Laramie, Wyo., district, where he formerly was situated.

Possible Legal Difficulties in Salt Creek Field, Wyoming

From Our Special Correspondent

Wednesday, Aug. 24, was the last day of the six months' period in which claimants to lands within withdrawn areas could relinquish their claims to the Government in order to apply for leases under the oil-land leasing act. The Salt Creek field in Wyoming is particularly affected by this act, as a large acreage is held by the Midwest companies under titles extending many years. Few applications for leases have been filed by the Midwest companies with the receiver of the General Land Office at Douglas, and it is believed an interesting legal battle for title to much of the land will result.

The well of the Trail Canyon Oil Co., recently completed in the Tisdale field, ten miles north and west of Salt Creek, will produce about 25 bbl. daily. The well is said to be 230 ft. deep and in the Dakota sand. About three years ago a test well which was drilled on this structure west of Salt Creek found only water.

Manitoulin Island, Ontario, Now Being Actively Developed

From Our Special Correspondent

Active oil development is in progress in the Manitoulin field by a number of companies and syndicates, and some good results have been obtained. The Standard Oil Co., which early in the century secured a lease of 30,000 acres in the Indian Peninsula and spent considerable money in exploration but afterward withdrew from the field, has resumed operations. An English syndicate headed by Sir Stopford Brunton has leased 25,000 acres. The Kyto Oil Co., of Dayton, Ohio, has brought in three wells at a depth of 456 ft., which have settled down to a steady daily production of 12, 15, and 18 bbl., respectively. Mr. Gordon, of Dayton, is drilling several wells near Manitowaning, and a Toronto syndicate has secured oil rights to a large tract in the southern part of the island. Interest in the Manitoulin field has been greatly stimulated by the work of M. Y. Williams, of the Canadian Geological Survey, which has materially increased the knowledge of its oil-bearing possibilities and has done much to encourage oil companies to develop the island.

Second Big Gas Well Brought in in Barren County, Ky.

From Our Special Correspondent

Another huge gas well is reported to have been brought in on the Smith lease near Temple Hill, Barren County. The first well, brought in two weeks ago, showed a production of 15,000,000 cu.ft. of gas daily, by the mercury test, and the second well is said to be even greater. It blew the tools, weighing 2,000 lb., far out of the hole. Four other wells are being drilled by Merry Brothers, who are responsible for bringing in the first two.

The Twin Lakes Petroleum Co., of St. Louis, brought in a 100-bbl. well on the Brawner lease in Simpson County on Aug. 25. It has a well started on the Ellis lease near Temperance, which will be shot soon. There is 45 ft. of pay sand at a depth of 570 ft. The company also has brought in a good well near the Reeder gusher in east Simpson County at 638 ft.

A 75-bbl. well was drilled in on Aug. 24 on the Davenport lease along the Barren River Pike, Warren County. The well on the T. K. Bohon farm, six miles west of Bowling Green, pumped 250 bbl. in twelve hours when it was brought in recently.

The Beech Bottom well, in Clinton County, eight miles west of Albany, is showing up well at 1,785 ft. The oil is standing 600 ft. in the hole. It probably will be drilled 20 ft. deeper. It will make 200 bbl. a day, according to estimates. This apparently opens a new deep field.

Australian Refinery Proposed—Crude From Papuan Fields?

Arrangements are being made to bring into effect the agreement entered into by the Australian government with the Anglo-Persian Oil Co. in accordance with which an oil refining company will be registered in Australia. The company will have a capital of £500,000 in £1 shares, of which 250,000 shares will be taken by the commonwealth government and 249,996 by the Anglo-Persian Oil Co., and three shares by nominees of that company. The company undertakes to work and equip a modern oil refinery in the commonwealth, and to control the sale and disposal of the products of the refining of mineral oil. Boring and developmental operations in the Papuan oil fields are proceeding, and if successful, the commonwealth will eventually supply 200,000 tons of oil per annum to the new refinery company for the purchase of which it holds an option. Meanwhile the Anglo-Persian Oil Co. will supply oil for the refining purposes up to the amount of approximately 200,000 tons.

ECHOES FROM THE FRATERNITY

Labor Emigration From Europe Checked and Controlled There

America Must Make Special Effort to Win and Hold Immigrants as Loyal Citizens—Few Laborers Coming Here

Frances A. Kellor, vice-chairman of the board of directors of Inter-Racial Council, has just returned from an industrial survey of Europe, and in the following paragraphs summarizes his observations and impressions concerning labor prospects of the near future:

"The time has passed," says Mr. Kellor, "when the American employer may count on an unlimited supply of labor from abroad. Emigration from Europe will be strictly regulated by the respective governments in the near future, and is already being directed in some of the Old World nations, which have begun to realize the value of their workers. The French government has offered Italy six tons of coal per month for each Italian miner induced to go to France, and Italy's Commissioner of Emigration is advising his people to emigrate to France. Greece is offering the inducement of farms to the people, and has passed an act requiring large land owners to surrender two-thirds of their estates to the peasants. Furthermore, emigration from Greece may be prohibited at any time by law. Similar conditions are found in Finland.

"These instances show the attitude of foreign governments toward their nationals. Emigration will be curtailed by many governments to the extent deemed expedient for their own interests. Furthermore, they will advise the emigrant where to go, and in some cases will retain him as a citizen with voting rights, even while living abroad.

"Immigrants who do come here will thus have less tendency to make America their permanent home and become citizens, and we shall have to make greater efforts than in the past to win over and assimilate them.

"Some of the foreign nations are planning to do the things which America should have done long ago: to protect immigrants from fraud, to establish official information bureaus, to take care of their savings through branch banks, and generally to look after their welfare.

"International agreements regarding immigration are being made between Old World countries. Hungary, Poland, Greece, Italy, France, Lithuania, Spain, Portugal, and the Balkan countries have taken the lead in such conferences, but the United States, which has so much at stake in the matter, has shown indifference. If our supply of coal, iron, oil, or cotton were threatened the whole nation would be aroused, but with the imminent curtailment of our labor supply, even at this time of acute labor shortage, the Government and the business men who should be interested are remaining apathetic. These are matters of direct immediate concern to the American business man. When the manifesto of a leader in Russia can react on the workers with greater force than the words of the plant executives —when a stream of literature in foreign languages can counteract utterances in the American press or in plant organs—it becomes essential to the self-interest of the American business man that he know about these things promptly and take adequate action in the light of his information on the facts.

"Meanwhile the tendency of the foreign-born workers to return to their old homes should be checked by every legitimate means. The most powerful inducement to them to remain is, of course, just and humane treatment, with no discrimination in wages, housing, and living and working conditions between them and the native born. Efforts should be made to establish closer relations with the foreign-born workers. If they have legitimate causes for discontent, the grievances should be understood and removed. The same spirit of co-operation that is being secured through enlightened employers and their English-speaking workers should be developed in relation to the foreign-born laborers. This is not 'coddling,' not philanthropy, but labor conservation.

"We should not be deceived by the temporary increase in immigration. The figures that indicate a large number of arrivals at Ellis Island fail to show the fact that the proportion of women, children, professional and clerical workers is so great as to afford little relief to our labor shortage. Of the manual laborers coming in, a large percentage are men who went abroad to fight, and are now only returning to their old jobs. Of new workers to do the essential work of America there is an exceedingly small percentage, and recent correspondence from all parts of the United States indicates serious shortage of labor in almost every section.

"The course of action for the employer is therefore, first, to conserve labor as carefully as he conserves his raw material; and, second, to regard immigration problems with the same interest that he gives to international commerce, realizing that America is no longer isolated and that what happens in the Old World today will be reflected in his own business tomorrow and the day after.

"An international conference on immigration is planned for 1921, in which the United States should play a leading part. Business men who are interested may obtain further details through the Inter-Racial Council, Woolworth Building, New York."

Organizations Invited To Join F. A. E. S.

The joint conference committee has been asked by one of the technical papers concerning the invitation to become a member of the Federated American Engineering Societies.

Pursuant to the request of the governing boards of the four founder societies, of the American Society for Testing Materials, of the United Engineering Society, and of the members of the Engineering Council, contained in the resolution unanimously adopted at their joint meeting on Jan. 23, 1920, the joint conference committee issued the call to the engineering and allied technical organizations of the country to attend the organizing conference in Washington, June 3-4, 1920, which was sent to engineering and allied technical organizations whose chief object is the advancement of the knowledge and practice of engineering and the allied technical arts and which were not organized for commercial purposes.

The organizing conference approved the list of organizations to whom the invitation was extended by the joint conference committee and no other organizations were added to this list by the conference. The joint conference committee is, therefore, extending invitations to these organizations to become members of the Federated American Engineering Societies under the authorization given it by the organizing conference on June 4, 1920. There may be other organizations which are eligible for membership. Such organizations may make application for membership to the American Engineering Council.

Montefiore Foundation Prize

The Association of Graduates in Electrical Engineering of the Montefiore Electrotechnical Institute announces under recent date that April 30, 1921, is the final date for receiving typewritten manuscripts or publications submitted in competition for the prize of 20,000 fr. offered by the George Montefiore Foundation. Memoirs must have been prepared during the three years preceding the meeting of the jury of award, must be in French or English and typed or printed. The award will go to "the best original work on scientific advance and progress in the technical applications of electricity in any field." Works of popularization compilations are barred.

The jury comprises ten electrical engineers, five from Belgium and five from other countries. Further details may be had by addressing L. Calmeau, secretaire général, Association des Ingenieurs Electriciens sortis de l'Institute, Etc., Rue Saint Cilles, 31, Liége, Belgium.

Dangers From Explosives Fumes in Metal Mining

Toxic Gases Always Present—Straight Nitroglycerine Never Permissible—Small Electric Fan-and-Pipe Units Needed

Two recent occurrences in Western metal mines, in each of which three men were killed, due to breathing fumes from explosives, have aroused keen interest among mining men not only as to the exact cause of such accidents, but also as to possible preventive measures. Both the accidents and their possible prevention are discussed as follows under the above title by D. Harrington and B. W. Dyer, engineers of the U. S. Bureau of Mines, in one of its recent reports of investigations:

In sinking the 45 deg. incline Marsh shaft near Burke, Idaho, on May 13, 1920, a round of holes containing about sixty pounds of 40 per cent gelatin explosive was blasted by the night shift on leaving at 11:30 p.m. It was customary for the night shift to leave compressed air blowers open at bottom of shaft until the compressor was shut down, slightly before midnight. Presumably this was not done on the night of the 13th, as the fumes were so heavy in the shaft bottom on the morning of the 14th that at about 8 o'clock, Superintendent Bergen and one of the shaft men, on reaching the shaft bottom, were overcome and fell from the bucket into the sump containing about six feet of water; and when two other men went down in the bucket a few minutes later to investigate, one also fell into the sump and the other was barely able to reach the shaft collar. The three bodies were later on recovered from the sump.

At 4:50 p.m., on June 10, 1920, at the Dominion Mine, Colville, Wash., a round of eleven holes containing about fifteen pounds of 60 per cent nitroglycerine explosive was blasted in a 50 deg. raise about fifty feet above the main tunnel level by the shift going off for the night. In this mine it was the practice not to try to blow out the fumes until just before the shift went to work the next morning. Although no work was being done on the night shift, one of the raise men, curious to ascertain the effect of the shots, about 7:45 p.m., wandered into the mine (which was a tunnel only a few hundred feet in length), and was missed by one of his companions about an hour later. When three men tried to remove the body of the inquisitive miner, two of them were also overcome; ultimately these two and the first man were removed from the point at which all were asphyxiated, which was practically at the foot of the raise.

In this case the explosive was seven-eighths *straight nitroglycerine*, used because the ordinary one-and-one-fourth gelatin was temporarily unobtainable, though the holes were drilled for the larger sized stick. The explosive, too, was about a year old. Though two of the eleven holes missed fire, there was no obtainable evidence of burning of explosive, but later on, after blasting these two missed holes, containing possibly three pounds of the explosive, an air sample taken a few minutes after blasting, and essentially at the point at which the three men had been asphyxiated, gave 0.79 per cent CO, or sufficient to cause death after having been breathed a comparatively few minutes. It was thought locally that the deaths were due to other gases, but analyses indicate strongly that CO was responsible.

These accidents indicate forcibly a danger daily confronting men working in metal mines and especially in small or prospecting mines. In one case, the dangerous fumes were in a shaft, in the other in a raise, the deaths in the latter being, however, practically on the tunnel level. Compressed air constituted the usual method for removal of dangerous gases, and in both cases it failed. In both accidents there is at present no obtainable evidence of defectiveness of explosive or of method of firing.

Dangerous Gases Always Present

Theoretically, there are in existence today explosives with constituents so chemically balanced that with complete detonation there should be no resultant gases of more potential danger than CO_2 which would be diluted to such an extent as to be practically harmless. Nevertheless numerous air samples at blasting faces in metal mines almost invariably reveal the presence of dangerous gases, due, generally, to incomplete combustion, these dangerous gases being usually CO and oxides of nitrogen. Dangerous percentages (upward of 1 per cent) of CO have been obtained at drift faces in metal mines after blasting with explosives of ammonium nitrate as well as gelatine base, detonated with No. 8 as well as with No. 6 caps, fired electrically as well as by fuse, tamped and untamped.

The most dangerous gas found in fumes of explosives is CO, of which quantities up to and over 1 per cent are frequently found in the general air around newly blasted faces in metal mines, and frequently as much as $\frac{1}{10}$ or $\frac{3}{10}$ of 1 per cent in air from muck piles several hours after blasting. This gas gives headache in air with proportions as low as 0.05 per cent; it is dangerous at 0.2 per cent and quickly fatal when over 0.50 per cent is present. Nitrous oxide is sometimes found, and its effect, though serious, is not likely to be so quickly fatal as that of CO. However, when dynamite burns instead of exploding, the nitrous oxide content of surrounding air may be sufficiently high to cause death. Other dangerous gases, such as H_2S and SO_2, may also be found in explosive fumes, but are rarely present in harmful proportions. However, straight nitroglycerine explosive dynamite gives off several times as much CO gas as gelatin or ammonium base explosive, hence *straight nitroglycerine should never be used in the confined places found in mining.* At present no explosive is applicable to metal mining in which there is any guarantee that formation of dangerous gases can be prevented in blasting; hence the one feasible preventive is effective ventilation.

Effective Ventilation Needed

It is significant that in 1919, the great coal mining industry of the United States had but three deaths from suffocation from explosives fumes among over 760,000 men, or about three times as many employees as in our metal mines. Metal mines only too frequently place entire reliance on natural ventilation or on compressed air, and both are likely to be inefficient, dangerous and, in the long run, costly. * * * For dead-end faces of drifts, crosscuts, raises, winzes and shafts, small electrically driven fans direct connected to one-half hp. to ten hp. motors force air through canvas tubing or galvanized pipe, and readily deliver 1,000 to 5,000 or more cubic feet of air per minute, or ten to fifty times as much air as can be obtained from compressed air blowers and at much less cost. These small fan and canvas pipe or galvanized pipe units not only remove explosive fumes from the face, but if operated as blowers will keep a stream of moving air at the point where the machine man or mucker works. In hot mines, especially, the worker's comfort and efficiency are greatly improved thereby and his health and safety assured at least as far as explosives fumes are concerned. Larger metal mines now recognize this and many new mechanical ventilation installations have been made in large metal mines, especially in the West, and the time will soon be at hand when laws will demand efficient ventilation providing circulation of ample currents of fresh air at all places where men work underground.

Dry Jackhammers Prohibited in Rand Mines

At a meeting held early in July in the offices of the Government Mining Engineer of the Union of South Africa, representatives of the Transvaal Chamber of Mines, the Mine Managers' Association, Underground Officials' Association, and of the South African Mine Workers' Union agreed that a new regulation should come into effect after March 31, 1921. This regulation, which is an amendment to No. 101 (1) (3) of "Mines, Works and Machinery Regulations," provides that "No person shall in the drilling of holes use or cause or permit to be used any machine drill in which only air is passed into the hole through the hollow jumper of the drill."

As the *South African Mining and Engineering Journal* says, the effect of this order on the mines remains to be seen. There are considerable numbers of dry jackhammers in use today on the Rand and also held in stock, and these will have to be scrapped or converted by the date mentioned. One estimate placed the cost of conversion at £9 per machine.

Book Reviews

Mica in the Eastern Transvaal—By A. L. Hall. Memoir No. 13, Geological Survey, Department of Mines and Industries, Union of South Africa; pp. 95; 17 plates, 8 text figures, 1 map; 6 x 9½; Johannesburgh, 1920.

As the first really comprehensive report on the Transvaal mica deposits, this memoir is a welcome addition to the literature on mica. The mica belt, approximately 300 square miles in extent, has been worked on a considerable scale since 1909, but until 1912 the nearest railway station was 120 miles distant. The opening in that year of the Selati railway, which crosses the belt, has given a great impetus to the industry. The muscovite occurs in coarse pegmatites in granites associated with basic rocks.

The deposits and workings of the six operating companies are described. An instructive feature of the report is the emphasis placed on the uncertainties of mica mining, and the practical importance of the physical condition of the product. Although some exceptionally large blocks of mica have been uncovered, on the whole the marketable mica is in comparatively small sizes. Data from two of the largest mines indicate that to procure one ton of mica, trimmed and ready for the market, it is necessary to mine from 850 to 1,700 tons of rock. A series of instructive tables are presented, giving prices of South African mica in the London market, dimensions and grades of sheet mica, chemical analyses, dielectric strength and percentage of various grades produced. At present the great waste in the mica fields is practically unused, and the author points out its possible successful utilization as ground mica. Transvaal mica compares favorably with that now used in Europe and America and with growing outside demand there is the prospect of a larger development.

A summary of conclusions condensed to half a page is a useful feature for the busy reader. Although less comprehensive than de Schmid's monograph on the Canadian deposits, the report is clear, instructive, and ranks favorably in the mica bibliography. O. B.

Retraining Canada's Disabled Soldiers.—By Walter E. Segsworth, M.E. Cloth; 7 x 10; pp. 193. Published by the Department of Soldiers' Civil Re-establishment, Ottawa.

Canada may be justly proud of the way she has handled this very human problem. The work was begun in 1915, and by the time the United States had the same problem to solve, our northern neighbors had much to tell us of their very satisfactory system, so well described in this book. Mr. Segsworth, a mining engineer, has been in charge of the work since July, 1917. The work has been centralized, and is perhaps being carried on more effectively in Canada than in any other country. Up to Jan. 1, 1920, over 33,000 returned men had availed themselves of the government's offer of training in a new occupation. Some were physically incapacitated from returning to their former occupations, others sincerely thought they were, and still others were not immediately able to take up the work to which they were accustomed, but might become so later. The government's interest in the men has continued after their graduation from training, so that accurate statistics are available as to the results secured.

This book will be of interest to all who have disabled men to take care of, whether caused by war or industrial accidents. Although devoting little space to mining and metallurgical work, many applicable ideas can be gained.

Technical Papers

Mica—"Mica in 1918" has been issued by the U. S. Geological Survey. Most of this substance comes from India, but the U. S. production in 1918, 822 tons, was the largest since 1913.

Smelting With Enriched Air—F. G. Cottrell and C. A. Meissner discussed the enrichment of air by oxygen, for metallurgical purposes, at the New York meeting of the American Iron and Steel Institute on May 28. The *Iron Trade Review* for July 29 republishes the papers, possibly in abbreviated form. With a cheap source of oxygen the practicability of the process is worthy of consideration, both in ferrous and non-ferrous metallurgy, though it is in its application to iron smelting that the authors are principally interested. Little practical work has been done, the papers being chiefly of suggestive value.

Gasoline—The July issue of *Reports of Investigations* (Department of the Interior, Washington, D. C., Serial Number 2,149) contains a motor gasoline survey. The quality of the gasoline supplied during the summer is ordinarily not as good as that marketed in winter, but that sold this summer seems to be worse than usual. Some samples were found diluted with kerosene. Of the seven cities in which samples were taken, San Francisco was found to have the most satisfactory gasolene, followed in order by New York, Chicago, Pittsburgh, Washington, New Orleans, and Salt Lake City, the poorest.

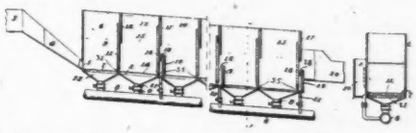
The Taylor System—In the August issue of *Industrial Management* (120 W. 32 St., New York, 35c.) is published the first of a series of articles on the application and practice of the Taylor system of management.

Geological Investigation—The Tennessee Geological Survey has again taken up the study of the Upper Cretaceous Series of West Tennessee, an illustrated report on which occupies fifteen pages in Bulletin 23 of the State Geological Survey (Nashville, Tenn.).

Recent Patents

1,346,817. Flotation Ore Separator and Process. Rudolf Gahl, Miami, Ariz., assignor, by mesne assignments, to Pneumatic Process Flotation Co., New York, N. Y. Filed June 26, 1915.

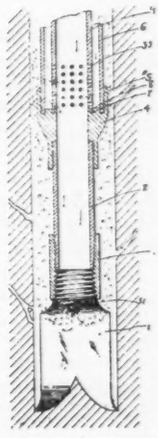
A flotation ore separator comprising a flotation tank divided into frothing compartments by partitions not reaching completely down to the bottom of



the tank, a concentrates delivery, and a whole-flow tailing discharge extending upwardly from the bottom of the tank beyond a frothing compartment.

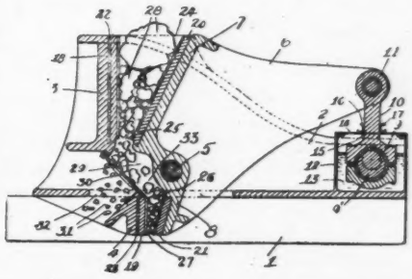
1,346,939. Method of Sampling. Robert E. Carmichael, Damon, Tex. Filed Dec. 1, 1919.

A method of raising the cuttings from an earth-boring drill to the surface comprising forcing a stream of flushing liquid downwardly through the drill stem and through channels in the bit to the bottom of the hole, forcing downwardly outside of the drill stem a current of compressed air, forcing the same into the drill stem toward the lower end thereof and causing the air to pass downwardly through the bit to unite with the flushing liquid and lift the cuttings and flushing material to the surface outside said drill and drill stem.



1,346,871. Crusher. Herman P. Andresen, Chicago, Ill. Filed April 30, 1920.

A crusher embodying therein a double-action jaw member mounted for swinging movement, spaced crushing portions thereon, spaced stationary crushing portions with which they



coact, the crushing portions on the swinging jaw member and the stationary crushing portions forming spaced pairs of crushing portions, and a sizing device arranged intermediate said spaced pairs of crushing portions.

MEN YOU SHOULD KNOW ABOUT

G. R. Mansfield is engaged in geologic field work in southeastern Idaho for the Geological Survey.

Samuel W. Cohen, consulting mining engineer, of Montreal, is in Newfoundland on examination work.

Kirby Thomas, mining engineer, of New York City, is investigating kaolin deposits of the Eastern States.

C. M. Heron is examining mining properties in the Lordsburg and old Apache mining districts of New Mexico.

George C. Martin is making geologic surveys in the Kuskokwim region of Alaska for the U. S. Geological Survey.

A. E. Drucker, mining engineer, was visiting mines and reduction plants at Butte, Anaconda, and Great Falls, Mont., at the end of August.

Jack Welch, general manager of the Majuba Silver, Tin & Copper Mines Co., Nevada, has been sick for several months and leaves soon for San Francisco.

Y. Nakayama, a metallurgical engineer on the staff of the Furukawa Mining Co., Marunouchi, Tokyo, Japan, has been visiting some metallurgical plants in the United States.

George Rupp has returned from a two-months' trip to the Hudson Bay country, where he and **Dwight Woodbridge** examined large deposits of iron ore on islands in the bay.

D. Dale Condit and **Robert W. Howell** of Washington, D. C., who were in Singapore April 21, are engaged in geologic field work in southeastern Idaho for S. Pearson & Son, London.

Everett H. Parker, who was graduated from Columbia School of Mines last June, is now looking over mines in England, after visiting the Continent. Mr. Parker expects to return to the United States about Oct. 1, and will then go to Butte, Mont.

J. E. Healey, general manager of the Consolidated Main Reef Mine & Estates, Ltd., Johannesburg, Transvaal, is in Los Angeles, Cal., while visiting America. He will visit San Francisco, Denver and Chicago on his way East and will sail from New York for London about Oct. 15.

Henry M. Payne, assistant to the president of Bertha Coal Co., Pittsburgh, Pa., has resigned to become general manager of the Douglass Barnes Corporation, 53rd St. and 5th Ave., New York City. Mr. Payne, who is a member of several directorates and mining organizations, assumes his new duties Sept. 20.

Rienzi W. Macfarlane, assistant superintendent of the Arizona Copper Mining Co.'s Longfellow group of mines, left Morenci, Ariz., for Parral, Mexico, on Aug. 12, expecting to be absent several weeks. Before the troubles of recent years Mr. Macfarlane was engaged in mining in the Parral region.

C. M. Lazuire, of the mining department of the California State Mining Bureau, has been appointed district engineer in charge of the northern California field division of the bureau with headquarters at Redding, Cal. Mr. Lazuire succeeds **Emil Huguenin,** who has been transferred to the oil and gas department, with headquarters at Taft, Kern county.

OBITUARY

J. GEORGE LEYNER

J. George Leyner, pioneer in the development of rock drilling machinery, inventor of the piston-hammer drill and the water jet-hollow steel system, died at Littleton, Col., Aug. 5. It is not generally known that Mr. Leyner also built the original shredded-wheat machines.

Benjamin Smith Lyman, geologist and mining engineer, died on Aug. 30 at Cheltenham, Pa. He made the first geological survey of Japan and his work there from 1873 to 1879 revealing and surveying valuable coal and mineral deposit won high honors from the Mikado.

Mr. Lyman was born in Northampton, Mass., Dec. 1, 1835, and was graduated from Harvard in 1855, and the Ecole des Mines, Paris, in 1861. He studied at the Royal Academy of Mines, Freiberg, in 1862.

After several years in private geologic work and as a mining engineer, he was employed by the Public Works Department of India surveying oil fields. From 1873 to 1879 he was chief geologist and mining engineer for the Japanese government. From 1887 to 1895 he was assistant geologist of the State of Pennsylvania. He was a Fellow of the American Association for the Advancement of Science and the American Institute of Mining Engineers and an honorary member of the Mining Institute of Japan.

SOCIETY MEETINGS ANNOUNCED

American Society of Mechanical Engineers will hold its 1920 annual meeting in Engineering Societies Building, New York City, on Dec. 7 to 10, inclusive. Sessions will be held on Appraisal and Valuation, and the Application of Engineering to Woodworking. The professional sections on Management, Power, Fuels, Machine Shop, Railroads, and Textiles will also conduct sessions; and a number of valuable papers will be presented at general sessions.

A memorial session for Dr. Brashear is planned as a fitting tribute to his life and work.

The Canadian Institute of Mining and Metallurgy will hold its second annual western meeting in Winnipeg, Man., on Oct. 25, 26 and 27. Headquarters of the meeting will be at the Hotel Fort Garry, Winnipeg. The local secretary, W. W. Berridge, may be addressed at 905 Union Trust Building, Winnipeg, Man.

Institution of Mining & Metallurgy, No. 1, Finsbury Circus, London, E. C. 2, will hold a special general meeting of the members and associates, at the rooms of the Geological Society, on Oct. 21, 1920, at 5:30 p.m., to act on a proposed revision of the conditions of admission and of membership dues in the institution.

The American Society of Civil Engineers, at its regular business meeting at 33 West 39th St., New York City, on Sept. 1, 1920, considered proposed amendments to the society's constitution, and the question whether the society shall join the F. A. E. S. as a charter member. A questionnaire on the latter is being mailed to members.

The Association of Iron and Steel Electrical Engineers will hold its Fourteenth Annual Convention at the Hotel Pennsylvania, New York City, Sept. 20 to 24. The program includes papers on transmission for industrial plants and underground transmission for Sept. 21 morning session, and the report of the electric furnace committee for Sept. 23 afternoon session.

A. I. M. E. Petroleum and Gas Meeting will convene in St. Louis, Mo., Sept. 21 and 22, in conjunction with the American Society for Testing Materials and the Petroleum Fuel Section of A. S. M. E. It is expected that this meeting will crystallize into a petroleum and gas section of the A. I. M. E. An invitation to attend has been sent to the American Association of Petroleum Geologists, and many of its members are expected to be present.

The Institute of Metals, 36 Victoria St., London, S. W. 1, will hold its fall meeting at Barrow-in-Furness, on Sept. 15 and 16.

THE MINING NEWS

LEADING EVENTS

Mining Situation in Mexico Rapidly Improving

August Exports of Copper, Lead and Zinc Show Increase—Demand for Iron Forces Price Up

The beginning of September finds operators in Mexico in a more optimistic mood than for the last four years. Although the price of silver has wobbled a bit, costs of production have been more favorable and the steady demand for lead has been more than encouraging. It is stated that 25 per cent of the railway cars of the Mexican lines are hauling silver and lead ores and that the exports of lead during August were only approached in quantity by those of copper. With the resumption of work on scores of old properties that had been closed down because of bandit activity, the production of lead promises to beat all records for many years. Prices in the local market beginning in September range from 70 to 75c., Mexican, per kilo.

A fresh impetus has been given to zinc, also, during the last sixty days and according to mining department figures thirty-one zinc properties were in full or partial operation on Sept. 1 in the states of Coahuila, Zacatecas, Nuevo Leon, Durango, Chihuahua, Jalisco, Sonora and Tamaulipas. In addition, a number of denouncements were made during August. Zinc mine owners suffered more in proportion than any other class during the revolution, as most of the properties were in the main track of the storm. Quotations run from 80 to 85c. Mexican per kilo. Most of the output is being exported.

Notwithstanding the closing down of the Democrata and some copper properties of minor importance, the total copper output of Mexico is increasing rapidly and the export exceeds that of any other metal, this in spite of unfavorable prices. For the first ten days in August nearly 600,000 kilos of copper were sent to the United States through the port of Naco alone. Heavy shipments also went through Agua Prieta, Topolobampo and from La Paz, in Lower California. The Boleo Company (French) is expecting to get back to its normal production of 400 tons daily, of which fully 85 per cent goes to the United States. The recent arrangement with Governor Cantu, of Lower California, enables the Federal government here to inaugurate a number of schemes looking to an extensive exploitation and development of the mineral resources of that back-woods section of the republic.

There has been a big jump in the local price of iron because of the demand for rebuilding the sugar plants, railways, mines and innumerable industrial concerns which were put completely out of business. The big iron and steel plant at Monterrey is breaking all records in way of output and the Consolidated and National iron and steel plants of Mexico City are practically taking no new orders. A few small furnaces are being opened throughout the country, but Mexico is depending largely on the United States for its iron.

Operations in antimony are light. Two small shipments arrived late in August from China by the way of Manzanillo. Both China and Japan are trying to break into the Mexican market.

WEEKLY RÉSUMÉ

The new so-called Mississippi Valley experiment station of the U. S. Bureau of Mines is to be established at Rolla, Mo., where work will be done in co-operation with the State School of Mines. The War Minerals Relief Commissioners are reported to have disagreed over the amount to be awarded on the Hanna Minerals Co.'s claim for over half a million dollars.

Steady improvement is reported in the mining situation in Mexico, as reflected in metal exports for August. The Cia de Minerals y Metales has been practically absorbed by the Penoles Mining Co. In Utah, the state public utilities commission has refused to allow the transportation rates on ore and coal to be increased. Hearings have been conducted in the suit of the Lone Pine-Surprise Mining Co. against the Northport Mining & Smelting Co. over extra-lateral rights on the Last Chance Black Tail vein. From Canada it is reported that the Belcher Islands, in Hudson Bay, have been visited by prospectors in an aeroplane.

Belcher Islands, in Hudson Bay, Visited by Prospectors in Airplane

For the first time in the history of northern Ontario airplanes have been used to assist prospectors. Within the past two weeks a large seaplane has taken geologists, prospectors and supplies from the railway to the Belcher Islands in Hudson Bay, where large deposits of iron ores are known to exist. The first leg of the journey was from the railway to Moose Factory on James Bay, and was made in about an hour and a half. This trip usually took about a week by canoe. The second leg was from Moose Factory to the islands and took about three hours. Several trips have been made from the railway base to the bay. Another plane, with a motion-picture outfit, is also operating in the same district. The iron deposits of the Belcher Islands were discussed by E. S. Moore in the *Engineering and Mining Journal* of Aug. 28, pp. 396-400.

Utah Commission Refuses Higher Freight Rates on Coal and Ore

Smelters Announce Increased Charges To Meet Increase on Bullion to Atlantic Seaboard

Increased freight rates as affecting the transportation of coal and ores within the State of Utah have been refused by the state public utilities commission, to which the Utah chapter of the American Mining Congress recently appealed, with especial reference to rates on low-grade ores. The Utah commission takes the ground that, provided state rates are fair and reasonable and proper in themselves, the interstate body has no authority to order them changed.

At present, rates on coal in Utah constitute 20 to 25 per cent of the price to consumers, and in refusing the proposed increase the commission stabilizes the price of coal to that extent. It was feared that higher rates on low-grade ores would cause many mines to close down. The smelters have announced increased charges to meet the increase in freight rates on bullion to the Atlantic seaboard. One notice says:

"We are advised that, effective Aug. 26, there will be an increase of 33⅓ per cent in the freight rates on lead bullion and blister copper to the Atlantic seaboard. In accordance with the clause in our contracts covering this matter, we are obliged to make deductions from the metal quotations to cover this increased cost. Metals received at our plant after this date will not be shipped out in bullion until after the freight advance has become effective, therefore on all ores or concentrates received at our Midvale plant on and after Aug. 20 we will make the following additions to our contract deductions from metal prices: Lead, 0.25c. per pound; silver, 1c. per ounce; copper, 0.25c. per lb. As was true of the previous deductions due to increased freight rates, an attempt at a fair division of the burdens between silver and lead producers has been made. We realize fully the many difficulties confronting the mining industries, difficulties in a like manner faced by the smelting industry, but we believe that these added costs should be absorbed and reflected in the market price of metals resulting from our related industries. An advance in metal prices can reasonably be expected to follow; we think this necessary in order that sufficient production of metals to supply demand may be encouraged. The shipper can be assured that in case freight advances announced should be modified by the railroads our deductions will be changed."

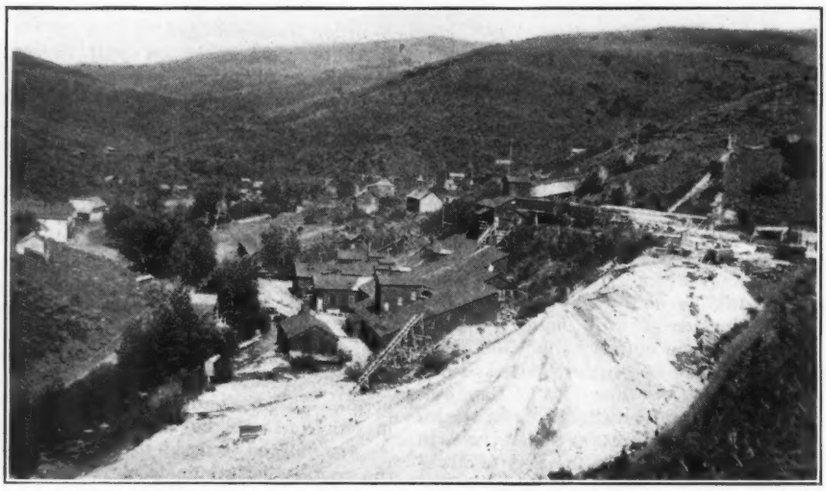
Reopening of Old De Lamar Mine Under Way

Property, Formerly Worked by Hand Methods Only, Now Being Modernly Equipped

By Robert N. Bell

The original De Lamar mine, which formed the basis of Captain De Lamar's fortune, is situated on the west slope of the Owyhee Range, sixty miles south of Boise, Idaho, and twenty-six miles from Murphy, the nearest railway point. It is in the Carson mining district, better known locally as the Silver City district, Silver City being seven miles away. The district is known for its production in the past of bonanza gold-silver ores.

A year and a half ago, the property was taken over by certain oil operators of Fort Worth, Tex., and Tulsa, Okla, who have since reopened the mill tunnel and the long and badly caved No. 8 level, and relaid the track. They have also put in over a mile of air line in



DE LAMAR MINE, MILL AND DUMP AT PORTAL OF TUNNEL, CARSON MINING DISTRICT, SOUTHERN IDAHO

these two levels, installed two compressors, and are refitting the mill and putting the property in shape for an aggressive development campaign.

Fully 80 per cent of the $14,000,000 worth of gold and silver produced by the De Lamar mine was derived from a series of closely parallel fissure veins that strike northwest and dip southwest at an angle of 45 deg. All of these are cut off and terminate at what is locally called the Iron dike, which is 10 to 30 ft. thick. This dike is decidedly crooked but has a general east and west strike and low southerly dip and the veins terminating on the under side show a decided drag or bend of 30 or 40 ft. to the west, closely parallel to the fault before diverging on their true northwest course.

This dike was definitely classified by Lindgren as a thick gouge-filled fault plane, its clay filling having practically the same composition as the enclosing soft ryolite wall rocks. It has a flat dip at the surface of about 30 deg., gradually steepening to 40 deg. at the deepest point penetrated on the 8th level. It cuts both the vein system and the ryolite at a sharp angle. In my opinion it is a fault of more recent date than the rich mineralization of the old ore courses and those more recently developed. On the south slope of De Lamar Mountain on the hanging wall side of the fault, several distinct ore-bearing fissures have since been discovered and developed to a limited extent.

The surface on the upper side of the fault is deeply covered with débris, which makes investigation there expensive and unsatisfactory. From the position of the ore found on the hanging wall side of the fault, a horizontal displacement of several hundred feet is indicated.

The latter years of operation were sweetened by the discovery of a series of narrow fissures, also under the fault and 500 ft. west of the original veins and parallel to them. These produced a total yield of fully $1,000,000 of $15 to $30 ore. This was known as the Summercamp group of veins. Three hundred feet west of this system and still under the fault another system of parallel fissures having a different type of gangue was partially developed, and for whose treatment the mill was not adapted on account of the extreme hardness of the gangue and sulphide ore. These newer westerly ore courses offer at present one of the most attractive chances for new ore development.

Due to the easy ground and soft gangue this property was always worked by old fashioned hand tool methods. An air compressor was never employed, even for development purposes, except temporarily for driving the 3,800-ft. crosscut tunnel from the Mill level on Jordan Creek through the hard basalt country rock.

Ten miles north of De Lamar the King, Berg and Rooster Comb mines, opening on steep pitching fissures in the granite formation at comparatively shallow depth, exhibit massive sulphide mixturs of lead, zinc and iron, carrying $20 to $30 in gold and considerable silver. Recent development on the 1,400 level of the Trade Dollar mine, five miles east of De Lamar, has exhibited some interesting specimens of lead-zinc sulphide associated with silver and gold. Also the big quartz-filled fissures of the Demming Mines, 10 miles further southwest, are conspicuously mineralized with arsenical and antimonial sulphides associated with lead, zinc and iron. These conditions of mineralization in the granite point strongly to the probable existence of similar primary ore conditions in the De Lamar.

At the west end of the De Lamar property, 100 to 300 ft. west of the Summercamp stopes, the Idaho vein exhibits an ore shoot over 200 ft. long, stoped 80 ft. deep, with a maximum width of 25 ft., from which a quarter of a million dollars worth of ore was extracted, running $25 per ton, principally in gold. It was so extremely hard, however, and involved so much handling to get it through the mountain to the mill tramway on the north side that it proved unprofitable and very expensive to mine with hand tools. During this development there was discovered between this vein and the Summercamp stopes what is now known as the New silver vein, a distinct fissure, 3 to 15 ft. wide and with a reversed dip filled with very hard, blue silicious breccia carrying silver sulphides and pyrite, averaging 12 to 120 oz. silver and only $1 to $2 gold per ton, forming a new type of gangue. This vein has been opened at several points on the surface and down to the No. 4 level but its most important development is at the No. 8 level through the Summercamp crosscut from the old vein system where it shows its best size and values. It has been drifted on for 80 ft. and the face is still 150 ft. short of the fault. This ground has also proven too hard to work with hand tools. It indicates a reserve of ore aggregating several hundred thousand dollars in value above the 8 level, 400 ft. vertically under the surface.

Another vein on the south side of the fault is developed in the No. 4 Summercamp crosscut tunnel and is known as the "M" vein. It has been stoped for a distance of 100 ft. and has produced a small tonnage of pay ore carrying $15 to $20 in gold. Two hundred feet east of this point, also on the south side of the fault, the Cash vein, a vertical fissure was discovered by panning and trenching the deep surface débris that covers the mountain slope. These shallow developments south of the fault are indicative that the fault is a post-mineral movement.

The production of the Trade Dollar Consolidated Mines on Florida Mountain, five miles east of the De Lamar, came from a series of nearly vertical fissures. The two productive veins outcropped in a thick sheet of altered ryolite, passed through this into basalt and then into the underlying granite. Its orebodies extended for more than 1,000 ft. along the strike and were equally rich in all three formations but faded in the granite at 1,700 ft. At the 1,400-ft. level a parallel vein, known as

the Empire, that was never developed because of too low grade, has recently been picked up by the Florida Mountain Mines Co., now operating the property, and is exhibiting a shoot of high-grade milling ore. This enterprise is also being financed by oil men from Tulsa and Fort Worth and has recently shipped some high-grade concentrates.

Large Russian Iron Ore Deposits Thought To Exist

A large body of magnetic iron ore is reported to have been indicated in the neighborhood of Kursk in the boundary sphere between Russian and Ukraine territory. The discovery is stated to have been made by earth-magnetic observations and calculations. These had been in process, systematically, for the last 24 years, and had been carried out by Dr. Ernst Leyst, professor of geology at Moscow University. Professor Leyst died in 1918, but his papers on the subject, including a number of charts with data on his calculations, etc., have been preserved and sent to Sweden, where they are being examined by Prof. Dr. Valfrid Petersson at the High School of Mines, and H. J. H. Nathorst. Both have come to the conclusion that Leyst's data can scarcely be explained otherwise than that they indicate very large iron ore reserves. Nathorst maintains that they clearly have to do with two parallel bodies of ore striking northwest-southeast, and about 60 kilometers apart.

Melting Down War Scrap Found Dangerous

In the metal scrap shipped to Gäfle, Sweden, from the Baltic provinces during the early part of summer for smelting a quantity of live projectiles were found. After an exhaustive sorting of the scrap by order of the state explosives inspector a couple of thousand live shells were taken out to sea and sunk at a depth of 27 m.

Similar discoveries of live shells in consignments of scrap have been reported at other points in Sweden, in particular Stockholm and Värtan. This scrap is brought over for melting down at various iron works and several explosions have occurred through live grenades being placed in the furnaces.

Iron Mountain Project Deferred

The newly formed Iron Mountain Furnace Co. of Iron Mountain, Mich., on the Menominee Range, has decided to postpone the construction of a pig iron furnace and chemical plant until next spring. Several Michigan lumber concerns are to have an interest in the enterprise, in order to insure a market for part of their product, a great deal of wood being used in charcoal and chemical plants of the sort. The furnace will hand'e about 400 tons daily.

The new State School of Mines at Miami, Okla., will open on Sept. 13, according to Lloyd B. Drake, president. Classes will be held in the mining exchange building until the school building is completed.

Germany's Industrial Situation As Related to Coal Supply

Iron Ore and Coal Insufficient To Keep Industries Going

From Our Vienna Correspondent

German industry faces a triple problem. It must find work for the industrial population, which is 43 per cent of the total. Germany has lost 70 to 75 per cent of its iron ore supply and expects a delivery of only 6 to 7½ million tons (metric) of ore. This suffices to feed only three-fifths of the former number of smelters making pig iron and steel, and at the best can make but 12 million tons of iron or three-fifths of the amount formerly produced. For this there must be imported at least 12 million tons of high-grade foreign ore. In view of the high cost of getting out ore, however, at present one may count on a production of only 7 to 7½ million tons of pig iron. To work up this amount Germany will need about 2.6 million tons of Lorraine-Luxemburg minette, 2.7 million tons of Swedish, and 1.4 million tons of Spanish ore. With these amounts one can barely satisfy the minimum requirements of 600,000 tons monthly, or 7.2 million tons annually in iron wares. If the iron industry itself must pay for the imported ores then one-eighth to one-sixth of the manufactured product must be exported. Only such surplus as may remain after minimum demand and cost of ore are satisfied can be applied as payment for other imports or for reparation (reconstruction). There will not be available the quantity of iron and steel necessary for an actual reconstruction of Germany—shipyards alone require deliveries of 45,000 tons monthly. Thus the German iron industry will become, in great part, a refining business.

In 1919 the German coal production, including Upper Silesia, amounted to 108 million tons or but 57 per cent of the supply of 1913. This decrease will not be counterbalanced by the slight increase in brown coal from 87 to 94 million tons, since the poor condition of the mines and the inefficient workmen have reduced the quality of the bituminous coal 12 to 15 per cent. The calorific value of the total coal production, bituminous and brown, of Germany, aside from the Saar district, amounted to but 57 per cent of the pre-war value, and would have been but 47 per cent without the supply from Upper Silesia. At the same time the mine consumption has risen, as has the amount assigned to the use of the personnel due to the increased number of mine workers.

The 1920 coal production may be estimated at 126 million tons, if no labor disturbances occur. Of this quantity, 70 million tons will be available for family, industrial and agricultural purposes. From October, 1919, to March, 1920, the limited total needs for all kinds of fuel for industry were met by only 57 per cent. Any further increase in coal production will be possible only if it is possible to restore the mines to their former technical level, and if sufferable accommodations are available for the newly employed workers. There is still needed, in all, about 150,000 more workmen.

Minerales y Metales Absorbed by Penoles Company

Former Gets 180,000 Shares of New Stock in Return for Holdings—Certain Oil Properties Not Included

An important operation in mining circles in Mexico is the practical absorption of the Cia. de Minerales y Metales by the Penoles Mining Co. At a specially called meeting of the stockholders of the latter concern at which 90,721 shares out of 120,000 shares were represented it was unanimously voted to increase the capital stock to 9,000,000 pesos, represented by 300,000 shares. Of this increase 180 000 shares were turned over to the Minerales y Metales stockholders in exchange for practically all the assets of the latter concern, with the exception of some oil properties, which remain with the M. & M.

Included in the transfer are the mining properties and smelter at Villadama, mines at Guanaceví, mines at Santa Eulalia and Avalos, mines and smelter at Cerralvo, smelter No. 2 at Monterrey, a large railway equipment and extensive holdings in real estate in various parts of the Republic. The transfer also includes a controlling interest in the Paloma & Cabrillas Mining Co., 81 per cent of the stock of the Agujita Coal Co., Coahuila, 83 per cent in the Cia. Metalurgica of Torreon, 40 per cent of the stock of the famous Naica silver mines, and 50 per cent of the La Parrena group of mines. All these properties are in the north, mostly in the states of Chihuahua, Durango, Zacatecas and Coahuila. There will probably be no change in the management and policy of the Penoles, and the active work of development and exploration will be continued as at present.

Would Shut Down Zinc District for Week's Festival

The remarkable proposal that an entire mining district shut down its mines for a week to attend a "fall festival" was made at the Picher meeting of the Tri-state branch of the American Zinc Institute recently. It was argued that the shut down would be a good thing for the operators and a favor to the miners. No action was taken.

The festival is to be held at Baxter Springs, Kan., and will include the annual drilling contest. It has been announced that Carthage limestone will not be used this year for the drillers to work upon, but a special rock, constructed of cement and "nigger head" boulders, which is expected to require more skill on the part of the drillers, and more time.

Lone Pine-Surprise Suit Begun in Spokane

Extra-lateral Rights Involved in Action Brought Against Northport M. & S. Company

The suit of the Lone Pine-Surprise Mining Co., of Republic, Wash., which has been brought to recover extra-lateral rights from the Northport M. & S. Co., began at Spokane recently. The plaintiff company is owned by the Day interests, of Wallace, Idaho. The property involved includes one of the prominent gold veins of the Republic camp. It is the contention of the Lone Pine-Surprise company that its Black Tail vein trends about half the length of the Lone Pine claim, then makes a sharp bend to the east and passes through the east side line of the Lone Pine claim into the Last Chance claim, where it is being worked as the Last Chance vein No. 2. The Northport company maintains that the Black Tail vein continues northward and that its vein No. 2 is a cross vein trending approximately at right angles to the Black Tail vein.

John Gray, of Coeur d'Alene, is attorney for the Lone Pine-Surprise company and W. E. Colby, of San Francisco, is handling the case for the Last Chance company. During the first two days of the hearing, Fred J. Searles, Jr., of Nevada City, Cal., and J. C. Ralston, of Spokane, appeared for the Lone Pine-Surprise company and William A. Simpkins, geologist, of San Francisco, for the Last Chance company. E. F. Babb and John Welty, original locators of the Black Tail vein, appeared and testified as to the continuity of that vein.

Recent Production Reports

Kennecott Copper produced 10,656,000 lb. copper in July (including Braden's output), compared with 10,120,000 in June.

Oriental Consolidated, Unsan, Chosen, reports its August cleanup as $75,500. The severe draught that had affected production is reported to be over.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Rolla, Mo., Gets Mississippi Valley Experiment Station

Will Co-operate With Missouri School of Mines in Studying Lead and Zinc Problems

Rolla, Mo., has been selected as the site of the U. S. Bureau of Mines experiment station, which will specialize in lead and zinc problems. The business office of the station will be located in St. Louis. The station will be known as the Mississippi Valley Experiment Station and will be conducted under a co-operative agreement with the Missouri School of Mines and Metallurgy at Rolla.

The exact problems which will be taken up at the new station will not be determined until the views of the lead and zinc operators are ascertained. Bureau officials will meet the zinc and lead interests of the Mississippi Valley in a conference at St. Louis on Oct. 9.

The statutory appropriation of $25,000 will be available for the new station. In addition, the Board of Curators of the University of Missouri will furnish, free, all the necessary office space at Rolla. Employees of the station will be given free use of the University's laboratories and libraries. The curators have agreed to include in their next legislative budget a sum sufficient to construct a new building especially designed to meet the requirements of the work of the station.

New Map of Arizona Offered for Sale

The Bureau of Mines of the University of Arizona at Tucson, in conjunction with the U. S. Geological Survey, has completed and is offering for sale a new map of Arizona. Special attention has been paid to designating the location of the several mining districts in making the map.

Relief Commissioners Disagree on Hanna Minerals Claim

Company Seeks Over Half Million—Pomeroy Would Award $229,603; Other Members Less

The feature of the work of the War Minerals Relief Commission during the week ended Aug. 28 was the disagreement of the Commission on the pyrites claim of the Hanna Minerals Co. This concern submitted a claim for $502,191.37. In the opinion of Commissioners Shaforth and Moore, the company is entitled to $140,397.48. Commissioner Pomeroy, however, considers that the company should have $229,603.21.

The Commission recommended an award of $600 on the $5,728 chrome claim of Gallagher & Grasselly. In addition, revised recommendations were made in several cases. The claim of Moore & Robinson had been disallowed, but on reconsideration, an award of $445 was recommended. This is 13 per cent of the amount claimed. The award of P. H. Bray was increased by $128.88, bringing the total award to $1,532.91, or 15 per cent of the amount claimed. Holbrook & McGuire were awarded $5,905.18 in July on their chrome claim. This has been increased to $7,216.85, or 46 per cent of the amount claimed. In June, a manganese claim by J. J. Cummings & Son was disallowed. On revision, $1,234.80 was allowed. The award was 15 per cent of the amount claimed.

The Commission continues to expect that its work will have been completed by Jan. 1. From present progress, however, it is believed that practically all of the important work will have been done by Dec. 1.

That the Relief Commission is a target for bouquets as well as for brickbats is indicated by the following letter from a claimant:

"As president and general manager of our company, I wish to express to you my thanks for the courteous treatment extended to our attorney and myself upon the several occasions of our meeting with you.

"The outcome of our claim has given relief without which our company would have been in a deplorable condition indeed. The amount received was less than the claim, but the ruling which eliminated the return of capital expended upon purchase of property and purchase of leases left you no alternative but to eliminate the large amount included in our claim. The latter we hope may be taken up at no distant date with the Secretary of the Interior as per his recent expressed willingness to do so.

"You expedited the settlement of our claim with all the speed at your disposal, and your departments throughout were most courteous and satisfactory to us."

Another letter received by the Commission in the last few days says:

"I received the registered letter from you recommending our award. I thank you very much for the recommendation, and even though we were out more than that, I feel that it is a liberal sum—a helping hand in time of need. There will be no objections. I write this as a letter of thanks and acceptance.

"Now, unless there is a certain rule and we must wait the twenty days, please have it sent me as soon as you can. The quicker I get it the more good I can do. I want to show some knockers around here that their Uncle Sam does treat us right, if we help in a pinch."

The Old Hickory powder plant near Nashville, Tenn., is to be sold. It was constructed during the war and is considered to be thoroughly equipped.

Mining Industry Needs More Aid From Government in Research

Knowing that plans are now being made for work during the next fiscal year, industries concerned with research and other functions of the Federal Government are calling attention to their particular needs. One of the insistent demands being made by the mining industry is for additional economic work on metal mining subjects. It is pointed out that the more easily obtained orebodies are being rapidly depleted and that future supplies must come from the poorer grades of ore.

The mines of the country are becoming so large that ventilation is demanding much more attention and, judging from correspondence reaching the capital, there is a very generally held opinion that the Federal Government is in a position to render valuable assistance in that particular.

No data are available on the exact effect of gases on the human system. It is known that the gases from explosives are poisonous but the degrees of poisonousness are not thoroughly understood. It is not even known in what concentration these gases may exist before they become dangerous to human beings. There is a determined demand for non-metals investigations, as well as for an enlargement of the Government's work on petroleum.

Rice Deplores Tendency To Increase State Taxes on Mines

A tendency to increase the state taxes which must be paid by the metal-mining industry is deplored by George S. Rice, chief mining engineer of the U. S. Bureau of Mines, who has just returned from a visit to the principal mining centers of the West. With the rise of agriculture in the metal-mining regions, the influence of that industry at some points has become predominant. As a result, the tendency has been to increase more and more the taxes which must be borne by the mining industry. It is Mr. Rice's opinion that, sooner or later, metal mining must receive every encouragement and the taxes levied should be, broadly, an output tax rather than one on potential reserves. It was Mr. Rice's observation that the gold-mining industry is placing very general reliance upon the passage of the McFadden bill, which provides a premium of $10 per oz. for the producers of newly mined gold.

One of the principal objects of Mr. Rice's trip was to explain the properties of liquid oxygen as a mine explosive. He believes that the metal-mining industry can effect important economies, under certain conditions, by substituting this explosive for dynamite. He calls attention to the observations of Dr. C. L. Parsons, the secretary of the American Chemical Society, who recently looked carefully into the use in Germany of liquid oxygen as an explosive. It is Dr. Parsons' belief that this explosive can be used to great advantage in this country. In Germany, Dr. Parsons found that it is being used successfully on small operations as well as in large mines. The Germans have developed machines for the making of liquid oxygen which can be placed on motor trucks and operated by the truck's engine. Machines of this character are made as small as seven liters an hour capacity.

Mr. Rice is very much impressed with the slime filling operations being used at Butte to extinguish the fire in the Leonard mine. He points with some pride to the fact that these operations are under the immediate direction of H. J. Rahilly, a former Bureau of Mines man. He also calls attention to the fact that the Anaconda company is making very effective use of the cement gun in combatting fire, a procedure recommended to the company by the Bureau of Mines. Mr. Rice predicts the successful outcome of the present campaign against the fire. He says the public does not take into consideration the many great expenditures on the part of the mining industry, of which this is an example. More than 200 men are constantly employed in this fire-fighting activity and the results obtained are considered satisfactory.

NEWS BY MINING DISTRICTS

MEXICO

Commission on Taxation Expected to Report This Month

Mexico City — There has been a marked improvement in mining conditions throughout the Republic during the last fortnight. The almost complete disappearance of brigandage, the advance in silver and the prices of various metals and the normalizing of the labor situation in most of the mining districts has brought a wave of optimism, rare for the last six years.

The increased consumption and advance in price of tin has resulted in the reopening of several properties in Jalisco, San Luis Potosí and Aguascalientes and by the end of the year a considerable export is expected. At the present there is a very slight import from the United States for home consumption.

The commission appointed by President de la Huerta to make a careful study into the mining situation with a view to reducing taxation along certain lines and suggesting minor changes in the mining laws is expected to make a final report early in September. The disposition of the government appears to lean toward any reasonable measures that will facilitate an early rehabilitation of the mining industry throughout the country. Already hundreds of small properties have begun work under the July decree cancelling fines and making special condition for back payments of taxes.

Zacatecas

Unusual Activity Noticeable in Zacatecas Camp

Zacatecas—The old camp of Zacatecas is waking from its Rip Van Winkle sleep and is taking on real activity for the first time in years. It is likely that hydro-electric power will shortly be brought into camp from the falls of Juanacatlan, in Jalisco. Local mine owners have guaranteed sufficient consumption to warrant the transmission and installation and the Federal government is also assisting the project, which means a great deal not only to Zacatecas district but to many intervening camps.

The San Cristobal is in process of reorganization preparatory to remodeling its mill and unwatering and operating its properties, which have been idle for eight years.

The Puerto Rico properties have been optioned and an examination is going on.

The San Andreas Panuco district, a short distance north of Zacatecas, has been sold to foreign interests, who are unwatering and shipping high-grade ore to Torreon.

The Penafiel property, also in the Panuco district, has erected a new hoisting plant and is preparing to work the mine with a large force.

The Providencia and Buena Suerte both erected new hoists and are taking out ore.

San Manuel is shipping high-grade ore to the Minerales y Metales at Torreon.

The old Veta Grande is at work again, mining above water in a strong silver and lead vein and shipping to the A. S. and R. Smelter at Aguascalientes.

The Parroquia mine, belonging to the estate of the late Frederick Palmer, now managed by Captain Barrett, is making a good production. The estate has also acquired the Magistral group and other adjacent properties.

The San Roberto, of which C. A. Bentley is manager and half owner, is making heavy shipments of zinc ore and also sinking a main shaft an additional hundred feet.

A. F. Main, of the Cia. de Inversions de El Oro, has taken an option on Los Campos properties east of the San Rafael and intends to unwater and

examine. Los Campos properties have been idle for over 30 years. Mr. Main has also taken options for his company on the Victoria and San Bernabe, within the city limits.

La Fe is making preparations to move its 300-ton mill about 15 leagues from its present property and has under consideration the erection of a large mill of 2,000-ton daily capacity to exploit their new purchases in that section.

Labor conditions have become practically normal throughout the entire district, and plentiful. There have been no strikes or unrest for several months. Railway facilities continue to be the principal drawback to extensive work and some of the important companies are attempting to acquire rolling stock of their own.

Oaxaca

San Juan Property Down Temporarily

The San Juan, which recently resumed work, has temporarily closed down because of its head frame collapsing.

The Natavidad Company, in the Sierra Juarez, is actively engaged in repairing its plant and expects to be in full blast by the end of October.

Several smaller mine owners in the Tavichi district have returned since the advent of the new government has restored peace and expect to begin operations before the end of the year.

CHILE

Santiago—A powdered-coal-fired reverberatory has recently been installed by Cia. de Minas de Cobre de Gatico. This furnace has a bed 80 ft. long by 18 ft. wide and is operating successfully on Chilean coal. About 200 tons of cold charge, it is said, is being smelted per day. One ton of coal is consumed for five tons of charge smelted.

CANADA

Ontario

Kirkland Lake To Deepen Main Shaft. —Financing the Davidson

Porcupine—The success of the arrangement for financing the Davidson Consolidated in England depends upon the willingness of the shareholders to option 50 per cent of the stock now in their hands to the new English interests. There has been some misapprehension as to the effect of this proposition, some shareholders objecting to the idea of a pool under which they would be unable to take advantage of market fluctuation. President G. C. Crean has issued the following explanation of the proposed transaction.

"The offer which was made by the English interests and which was communicated to the shareholders was as follows: 'The English syndicate would purchase 1,500,000 shares of treasury stock at a price of 75c. per share net to the company, amounting in all to $1,125,000, on condition that they could secure an option on 2,000,000 shares at present in the shareholders' hands; the treasury stock to be paid for on or before March 31, 1921, and the option on the shareholders' stock to remain in force until nine months after the first 500-ton unit of the mill is completed, but in no case to exceed a period of two years.'" President Crean points out that every shareholder will have to option 50 per cent of his holdings, leaving him free to dispose of the remaining 50 per cent should he care to do so. A refusal on the part of the shareholders to option their stock would mean that the offer of the English interests to put money into the company could not be accepted. The company is dependent on the securing of this money, and failing the same would have no other alternative than to assess the shareholders to provide for building the mill and carrying on development.

The Clifton will be extensively diamond-drilled in order to ascertain the extent of the continuation of orebodies opened up in the workings.

Kirkland Lake—The Kirkland Lake plans to sink the main shaft situated in the center of the property down to the 700-ft. level, where connections will be made with No. 1 shaft now down 919 ft., making the drift on the 700 ft. level the main haulage way for all ore broken between the two shafts. Raises will be made from the 700 ft. level and ore mined on the upper levels passed down to be trammed to the main shaft. The rock formation at 900 ft. depth is similar to that occurring on the upper levels. Total operating costs have been reduced to $6.21 per ton.

Sesekinika Lake—The Height of Land Gold Mining Syndicate has been formed to operate two groups of claims, one block of eight being on an island in Sesekinika Lake and another group of eight claims lying at the corner of Benoit, Melba and Maisonville townships. A force of men has been engaged and camps are being constructed.

Wolfe Lake—The Lakeview has finished the building of camps and done considerable surface work. A mining plant is being brought in and sinking will be undertaken in the hope of striking a continuation of the Murray Mogridge vein.

Gowganda—At the Trethewey a shaft is being sunk on the "office vein" which faulted at a depth of 34 ft. but was picked up by crosscutting and high-grade ore taken out. The main shaft has been carried down to the 150-ft. level where a crosscut has encountered three new veins.

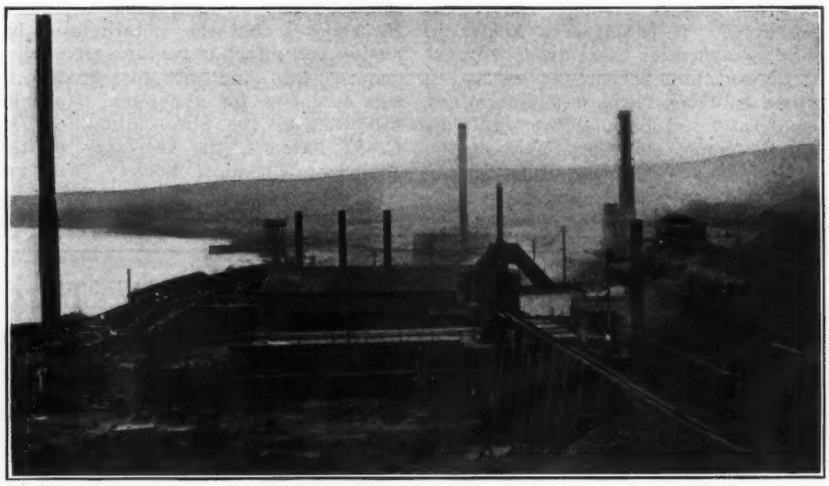
British Columbia

Nelson—Remodeled and with more equipment, the California-Athabasca mill, situated on Give Out Creek above Nelson, has started operations after three trial runs. The plant will treat the ore of the California now being developed by the California mining company, of which John Cassin, of Spokane, is head.

Trail—Ore shipments received at the Consolidated smelter during the week ended Aug. 31 were as given in the following table:

Mine	Location	Gross Tons
Bluebell,	Riondel	156
Canada Copper,	Greenwood	11
Iron Mask,	Kamloops	83
Josie,	Rossland	296
Mandy, Le Fas,	Man.	372
McKay & Erickson,	Mayo, Y. T.	3
Monarch,	Field	37
North Star,	Kimberly	251
Sally,	Beaverdell	45
Providence,	Greenwood	72
Skylark,	Greenwood	16
Silver Standard,	New Hazelton	41
Venus,	Carcross, Y. T.	20
Company mines		9,854
Total		11,257

The gold receipts at the Dominion of Canada assay office, Vancouver, B. C., from January 1 to July 31, 1920, total at $1,073,451.17. From April 1 to July 31, 1920, they aggregated $819,216.72, or about $200,000 per month for the four months of the fiscal year 1920-21.



SMELTER AT CIA DE MINAS DE COBRE DE GATICO, CHILE. NEW COAL-FIRED REVERBERATORY IN FOREGROUND

CALIFORNIA

Lack of Power Hampers Mother Lode Operations—Paxton Discusses Conditions at Engels Copper

Sutter Creek — Mining operations along the Mother Lode are seriously hampered by lack of power. All the companies have been compelled to reduce their power consumption materially. At the Central Eureka mill only twenty stamps of the forty are dropping, and that number for only sixteen hours out of the twenty-four. Other electrically driven machines about the mine have also been put out of commission in whole or in part, until such time as additional power can be obtained. Without early rains this condition may exist for some time, and at those mines which are barely meeting expenses or running on assessments the situation seems serious.

Despite adverse conditions the Central Eureka is continuing development on the 3,900 level. A crosscut west from the shaft located a good orebody and indications are that it has both permanency and value.

Volcano—Work on the debris dam half a mile from this old mining camp, in preparation for extensive hydraulic operations by the H. L. Crocker Co. of San Francisco, is nearing completion. Besides the Elephant deep gravel mine, the company has options on several pieces of property in the district. The dam is being constructed of stone and earth and will be about 30 ft. high and 429 ft. long. The debris will be carried to the dam by a flume about 700 ft. long. A spillway 125 ft. long north of the dam has been completed.

Nevada City—Howard M. Black and associates are engaged in opening up a small gravel mine near the Parsons ranch in the Banner section. A tunnel has been driven and upraises are being put in to intersect the true channel. A form of gravel has been encountered and it is hoped to find the pay channel believed to exist there. Several years ago about $10,000 was taken from a small deposit of gravel discovered on the property.

Marysville—P. F. Roosa, of Washington, D. C., was in Yuba County recently obtaining records of chrome production during the war. When these reports are filed in Washington, action will be taken on reimbursing producers for the chrome ore they were unable to sell after the armistice.

Englemine—General Manager Paxton, of the Engels copper mine, has made the following report concerning operations and developments at the mine: "The Engels copper mine today has enough high-grade ore in one solid block, actually proven, above the 6th level in the Superior mine, to more than pay for, at the present market price, all the company's stock now in the hands of the public. In spite of the labor shortage, which has been acute, we have added half a million tons to our proven ore reserves, since January 1, and should operating conditions not improve, we confidently expect to add another million tons to our blocked out reserves before the end of the year. Development of the Engels is proceeding most successfully. We have sunk a shaft 200 ft. to level No. 7, and are developing the ore in this large body of high grade. It is between No. 6 and No. 7, that we propose to block out the extra 1,000,000 tons before the close of 1920. We have drilled 400 ft. below level No. 7 and have cut considerable orebodies at this depth."

There are now twenty copper mines and prospects being operated along the Plumas copper belt, with the Engels and the Walker as chief shippers.

Portola—The Gruss copper mine now has its mill in operation and developments are being pushed with increased efforts. H. W. Turner has just completed his report on the results of his examinations of the Gruss property, in the interest of local financial men. It runs in part as follows: "In the report no mention is made of the reserves of oxidized gold ore, which were not examined. Attention was given only to the sulphide ores of the underground levels, which are suitable to be treated in the present oil-flotation concentration plant. More recently a new shaft was sunk to the depth of 400 ft. Connection was made with the old 90-ft. shaft (70 ft. down in the new shaft) and levels were run at 200 and 400 ft. In all of this lower ground the ore is largely unoxidized and consists of copper sulphides, bornite, chalcopyrite, and chalcocite with gold and silver. Practically all of this ore is found in the footwall rock, a kind of porphyry, technically called meta-andesite. The main vein is known as the Contact vein, since it lies at the contact of porphyry and clay slate, the porphyry forming the footwall and the clay slate the hanging wall. The strike of this main vein is northwesterly and the dip southwesterly. No attempt was made to sample the mine as a whole, but sample of 400 sacks of mill-feed ore taken from the raise on the 20-ft. level gave the following assay per ton of ore: Copper 2.96 per cent; gold 0.05 oz.; silver 2.85 oz. The superintendent is of the opinion that he can extract sufficient mill-feed of about this grade to keep the mill in continuous operation."

Golden Gate—The Golden Gate mine in Mono County, Cal., nine miles from the Nevada line, has recently been taken over under bond and lease, with the usual cash payment, by Wade Armstrong for the Diamond Peak Mining Co. This is the twelfth time since 1901 that the Golden Gate has been "turned," a substantial cash payment having been made and considerable development done in every case by the intending purchaser, but eleven deals failed of consummation and the property reverted to the owner, Joe Brown. Development to the extent of a mile of tunnels, drifts, crosscuts and shafts have been done on the mine, and it is equipped with a 20-stamp mill. The ore carries gold values and is free milling.

Grass Valley—With the exeception of the Empire, all of the mines here will be able to keep virtually their full forces employed, despite the power restriction, providing the period of curtailment is not too long. The North Star and Idaho-Maryland will use the extra labor at work not requiring power. The Empire has laid off about 150 men, but may be able to recall some of them later on. Partial assurances are given that the 20 per cent restriction will not extend beyond one month.

NEVADA

Rochester Plants Expected to Resume Soon—United Comstock Active at Gold Hill

Tonopah—The Tonopah Extension's work of sinking its Victor shaft to the 1,860 level has been delayed for the past several weeks on account of a lack of experienced miners, but work has now been resumed. Crosscutting from the McCane shaft, in the 1,200 level, to the No. 2 shaft workings has been started. About 500 ft. of work will be required and then shaft sinking will be started.

Development for August in the West End totaled about 600 ft. with no new discoveries of importance reported. Crosscutting in the Tonopah "76" ground is being done at the rate of about 120 ft. per month with no change in formation as yet, which is favorable. Profits of the West End for July are announced as $48,803.17 from 4,039 tons of West End mine ore and 526 tons of Jim Butler Lease ore.

In the Tonopah Belmont good ore is being followed in a foot-wall drift under the Belmont vein on the 1,200 level. Normal development work was accomplished on levels from the 700 to the 1,200, with no new discoveries satisfactory results.

The Tonopah Mining Co. shipped 1,450 tons of ore to the Millers mill last week, and 109 ft. of development work was performed last week in the Silver Top and Mizpah ground, mostly in the latter.

Active work is being performed in the California Tonopah, in the southeastern portion of the district, and considerable ore of good grade has been developed above the 700 level in narrow veins. A winze is being sunk from the 700 level and crosscutting will be done from the 900 under favorable conditions.

Divide—Recent developments in the Divide district have stimulated interest in the entire Divide district. Official statements are to the effect that drifting and crosscutting on the 165 level are producing very satisfactory results. The vein has been proven to have a width of 17 ft., with an average value of $25 per ton in these latest workings. The shaft is now 1,000 ft. deep and after sinking an additional 25 ft. or more for sump purposes crosscutting south to the vein is to be begun. The work from this level is of utmost importance to the Tonopah Divide mine and to the Divide district as a whole. With no deterring factors the crosscut should

reach the projected position of the vein, which is practically vertical and was reached at about 150 ft. from the shaft on the upper levels, in about two months. Regular shipments of about 30 tons per day are being made to the MacNamara mill at Tonopah, the ore averaging about $25 per ton.

The Brougher Divide, to the west of the Tonopah Divide, is doing work on the 500 level, and occasional bunches of ore have been encountered.

The Gold Zone, on the southeast extension of the Divide vein, are crosscutting on their 700 level to cut the downward extension of the ore shoot as followed downward in a winze from the 500 level.

Pioneer—The Consolidated Mayflower Mines Co. are sampling the Mayflower and Starlight orebodies with the idea of estimating ore reserves and as a basis for future development.

Gold Hill—The new boarding and bunk houses of the United Comstock Mines Co. are nearly completed. A large force is employed and Gold Hill, which is close to Virginia City on the Comstock lode, is assuming some of the old-time activity. A new headframe has been built and a new compressor house is going up at the Belcher shaft. At the Jacket, the company will house the compressor and is crosscutting from the shaft to the headings for the haulage tunnel. At the Imperial, it is planned to resume shaft sinking. Crosscutting is continuing here.

The Virginia & Truckee R.R. Co. is figuring on cementing the Yellow Jacket tunnel through which the road passes between Gold Hill and Virginia City. If this is decided upon a cement gun will be used, this being the most practicable method.

Ione—Work has been resumed by the Nevada Quicksilver Mines Co. near Ione, 60 miles south of Austin. This property, which has been idle two years, is said to have a production record of 5,000 flasks and to have ore sufficient to keep the 50-ton furnace busy for some time.

Rochester—The Lahontan reservoir is filling and water will soon be available for generating electric power. It is expected that the mines and mills at Rochester and Packard will be able to resume operations soon.

Jean—Important disclosures of vanadium are reported from the Christmas Consolidated mine, nine miles southwest of Jean. It is said that offers have been made both for the ore and for the property.

Eureka—A new orebody has been opened up in the Eureka Holly mine from which shipments at the rate of 200 to 300 tons per month are being made except when there is a shortage of railroad cars.

The Ruby Hill Development Co. has over 800 tons of ore in bins and plans to ship regularly if cars are provided. Unwatering of the Locan shaft is progressing.

Mina—Demonstrating the continuity of the hanging-wall orebody from the 6th to the 7th level in the Simon Silver-Lead mine and indicating that the present ore reserves of approximately 500,000 tons will be almost doubled, the recent strike of high-grade milling ore in that mine in the raise driven from the lowest level has aroused much interest in the district. Engineers estimate that there has now been added more than 150 ft. of backs available for stoping operations. Ore has been followed in the raise for approximately 100 ft. Work is under way on the plans for the new 100-ton flotation mill. The millsite has been surveyed and mapped and engineers are now examining the footwall territory adjacent to the mine with a view to selecting the spot for the new working shaft.

ARIZONA

Arizona Bisbee Offering New Stock—Little Activity in Empire District

Bisbee—The Arizona Bisbee Copper Mining Co. is continuing drifting on its 400 and 600 levels. Both drifts are in a hard blue limestone with occasional stringers of iron oxide. It is expected that the faults toward which these drifts are advancing will soon be cut. About 20,000 additional shares of stock are being offered to the public at 50c. per share. The property is located about two and one-half miles west of the Whitetail Deer country in which several lessees are operating.

The Wolverine & Arizona has temporarily shut down underground operations. Repairs are being made to its hoisting equipment and compressor.

The sulphide ore recently struck by the Boras Leasing Co. is continuing. The width of the ore is about 12 ft. Development work has not gone sufficiently far to determine its length.

Empire District—There is now practically no work going on in the Empire district, which is located in a spur of the Santa Rita Mountains about half way between Benson and Tucson. The Hilton brothers are producing a small amount of lead-silver ore from their property. The Forty-nine mine was closed down four weeks ago. The Total Wreck is the largest mine of the district with a production of about $450,000. It has not been worked for over ten years.

Phoenix—It is claimed locally that the "Lost Dutchman" mine of the Superstition Mountains has been rediscovered. A property thus dubbed has been located around an old shaft that was found covered with mesquite timber, this spread with rock and dirt to obliterate all evidences of mining. At 100 ft. depth, it is claimed, a ledge has been found showing ore worth $400 a ton. The ore, it is said, is to be packed on burros to the Roosevelt road and shipped from Mesa station.

Globe—The El Paso Iron & Bridge Co. is completing construction of a large head frame at the upper shaft of the Arizona Commercial.

New Dominion is said to have financial backing in New York and is to sink its shaft to 1,200 ft. from the present 800-ft. level.

Douglas—The Hilltop mine in the Chiricahuas has developed a large tonnage of shipping ore, but operation is hampered by a labor shortage.

Superior—Magma Copper has further increased its large local holdings by purchasing the Easton and Smock group on the west and the Superior-Safford group on the east.

Jerome—Cores from drillings from the 1,300 level of the Verde Combination at 450 ft. of depth are showing ore well shot with chalcopyrite.

Encouraged by the Shea strike, the directors of the Pittsburgh-Jerome have instructed Charles Arata, the superintendent, to resume diamond drilling. A hole from the lower workings is to be completed and then there will be started a 2,400-ft. hole from the surface.

Miami—At a sheriff's sale, on a single bid of $300,000, the Cactus copper property has been bid in by the Susquehanna Trust Co., which holds a mortgage claim upon it for $390,000. The group of four patented and many unpatented claims lies in the Pinto Creek section, west of Miami. It has had much development, including churn drilling, and it is understood some commercial ore has been found. At one time the stock was quoted at $10.

Gila Bend—The Rowley property on the Gila River northwest of this point, has been closed, pending installation of needed pumping equipment.

NEW MEXICO

Freight Increase Stops Manganese Ore Shipments from Stevens Property

Silver City—Shipments of low-grade manganiferous ores from the Stevens property have been stopped, the increase in freight, which amounted to $2.20 per ton, having absorbed all the profit. An effort will be made to have the old rates re-established. M. W. Porterfield, who has been in charge of operations, is in Chicago in an effort to get relief. Shipments had been running about 350 tons daily to the U. S. Steel Corp. in the Pittsburgh district.

The Silver Spot mine shipped a car of good-grade manganese ore on July 28 making 7 cars shipped in 60 days.

Work of installing the new cyanide mill at the Cora Miller mine in the Mangas Valley is progressing satisfactorily. Milling operations are expected to begin about Oct. 1. Two 60-ton redwood tanks, a number of smaller tanks, engine beds, buildings and residences are completed.

Torbernite ore is reported to have been found in the Lucky Bill mine of the Black Hawk Mines Co. at Bayard Station in the Central district.

Pinos Altos—The Mexarco Mining Co. have leased their Langston property to the Hecla Mining Co. a new organization, not to be confused with a company of the same name owning property in the Lordsburg district. Work will start at once.

Kingston—The Lady Franklin group is being operated by Minor C. Keith and associates of New York, under the direction of W. H. Paul. About 20 men are on development work. Some shipments of silver ore have been made recently to El Paso smelter.

Empire Zinc is working a large force on development work under C. T. Brown. New machinery has been installed recently.

On North Percha Creek, the Moffett Consolidated Mines are continuing their development with encouraging results. An air compressor, drills and 60-hp. gas engine are being installed. The same company owns a group of copper claims 15 miles north of Elephant Butte dam, where work will be started soon. A mill is planned.

Chloride—Silver Mountain Metals Co. claims to have shipped $10,000 silver ore to El Paso smelter recently. Old concentrator on the property has been repaired and will be put in operation soon. John H. McCutcheon is manager.

The old Colossal has been equipped with new machinery by Albuquerque parties who are figuring on a mill at an early date. Both the Midnight and the U. S. Treasury properties are working.

Lordsburg—The Ruby Silver Mining Co. has been reorganized with an authorized capital stock of 500,000 shares of a par value of $1. L. P. McHalffey, a local attorney, is president. The property has been paid for and work will again be pushed under the new management. Development to date consists of three shafts, 220, 150 and 40 ft. deep respectively, all showing some ore.

The main shaft of the C. & A. Mining Co.'s 85 mine is down 960 ft. It is locally reported that good ore has been cut with the diamond drill at 1,700 ft. from the surface. K. I. Mohler is superintendent.

The Octo Mining Co. is working 60 men and pushing the exploration cross cut, which at 70 ft. from the shaft has encountered ore and water. The main shaft is 325 ft. deep. New residence buildings are being erected.

COLORADO

Test Run To Be Made at Pony Express Mine at Ouray—Senorita Mine Sold

Ouray—The Eurades Mining Co. has built a large food cellar and is now doubling the capacity of the bunk house; they plan to carry on the active development work now in progress, throughout the winter, drifting and raising, and expect to employ forty men. Several carloads of food are on the way.

The Senorita mine, north of Ouray, has recently been sold to outside people represented here by Mr. Myers. A contract will be let for continuation of the lower tunnel to develop the main orebody. Meanwhile, the dump has been sampled and tests of a new process of treatment have been made in Denver; these tests are said to have yielded excellent results and it is Mr. Myers' intention to erect a treatment plant on the railroad below the mine in the near future. The new process involves roasting with reagents and cyaniding.

A test run is to be made on the Pony Express mine by C. R. Wilfley for Delta people. A hundred tons of ore is to be mined by hand, hauled to Ouray by wagon, and run through the Gold Crown flotation mill. This, while expensive on a small scale, will determine thoroughly the average value of the large low-grade orebody developed in the Pony Express mine, and at the same time give a fairly good idea of the possibility of treating the ore by flotation. If the test shows good results, a mine plant will be installed and milling undertaken at the Gold Crown mill. A mill will be erected at the mine if this venture proves successful. For the second stage, regular milling at the Gold Crown mill, it is expected that bids will be asked for hauling the ore by auto truck.

The Hidden Treasure mine continues to ship lead-silver ore to town for shipment to the smelters. Considerable ore was accumulated at the mine last winter while the roads were impassable and it was announced that this ore would be shipped rapidly when the roads opened, while plans were also made for erecting a small mill at the mine. Much of the shipping ore remains at the mine and nothing has been done in the way of a mill.

Davis & Hall, working a portion of the Bi-metallist, have opened up some excellent high-grade gold ore. This property yielded $50,000 very quickly and cheaply a few years ago, in high grade gold ore, and has excellent possibilities.

The new freight rates will work a great hardship on this district—in fact, some mines are already seriously considering a shut-down.

UTAH

Ophir Tunnel Face in Mineralized Ground—Silver King Coalition in Promising New Ground

Ophir—The tunnel of the Ophir Silver Mines is in 700 ft. This is being driven to cut at depth the ore-bearing limestone of the district. Silver mineralization is beginning to show as the work approaches the contact. Considerable water is coming in.

Park City—At the Silver King Coalition, exploration in new ground promises a productivity equal to that of the older portions of the property. Developments between the 1,300 and 1,500 levels would appear to indicate that the new shipping ore opened in the O'Brien fissure in the "Blood" drift on the 1,100 level is persistent. The showing in the "quartz" drift on the same level is equally promising, it is said. Ore has also been opened near the Brown raise between the 1,200 and 1,300 levels, which appears to be a continuation of the old "Copper stope" orebody, productive of a large tonnage of specially high grade copper-silver ore in early days.

Eureka—Shipments from the Tintic district for the week ended Aug. 28 amounted to 141 cars as compared with 121 cars the week preceding.

Silver City—The Tintic Milling is preparing to add to its present source of water, which is supplied by the Chief, by taking water from the Ruby Hill shaft of the Tintic drain tunnel also. The new system of sluicing instead of tramming the tailings on to the flat below the plant requires more water than formerly. About 200 gal. per minute is being used.

Alta—The Columbus-Rexall between June 4 and Aug. 31 shipped 44 cars of ore, amounting to about 1,500 tons dry weight. Present shipments amount to three cars a week, and could be considerably increased if more labor were available. The company reports two promising oreshoots opened recently, the development of which, however, is being held back by labor shortage.

MONTANA

Anaconda Adds Lead Stack at Great Falls Plant

Butte—The addition of a lead stack is one of the latest improvements at the Boston & Montana smelting works at Great Falls, one of the old copper reduction works' stacks being remodeled to effect a saving of the lead content had from the residue from the electrolytic zinc plant. The recovery of the lead will be confined to chiefly the company's own ores and will add considerable to the recovery of values from zinc ores, which are running fairly well up in lead, particularly the ores from the Nettie mine, in the western part of the Butte district and from the Hibernia of the Davis-Daly. This will be the first saving of lead in the Montana plants of the Anaconda.

The No. 2 shaft at the Black Rock mine is now well below the 2,300-ft. level and the sump will be completed within a short time. From the 2,300 level a crosscut will be driven to a point under the No. 3 and a raise then driven to connect with the latter, the principal working shaft of the mine. This will bring the No. 3 shaft to the 2,300-ft. level without any interference with the hoisting of ore or the maintenance of tonnage.

Ore is mined by East Butte Copper on practically all levels of the Pittsmont mine at present, with new ore being developed on the 1,800-ft. level in a satisfactory manner. It is expected to push development on this level within a short time, a heavy flow of water from the face of an ore-bearing vein opened some time ago interfering with work to such an extent that it was considered more economical to delay operations and permit it to drain itself. East Butte's Pittsmont smelter for the first seven months of the present year has turned out 10,446,700 lb. of copper as compared with 10,359,260 lb. in the corresponding period in 1919, with production costs reported to be a shade under those for the previous year, when they averaged 16.69c. per pound of metal.

Working force at North Butte's Sarsfield property on the east side is being increased and the showing had on the 900-ft. level is said to warrant the continuation of development. Cross cut-

ting continues on the 3,600-ft. level of the Granite Mountain mine with the Edith May vein the objective. Completion of repairs to the Speculator shaft has enabled a resumption of development work on the 700-ft. level together with mining operations. The showing of the Adirondack vein on the 2,200-ft. level is proving somewhat of a disappointment, but there appears to be promise of some improvement with drifting. The North Croesus vein is showing an improvement with depth, a wider and higher grade orebody being found on the 2,800-ft. level as compared with the 2,200. Owing to the poor supply of experienced miners and the unsatisfactory condition of the market, work at the Bertha mine has been temporarily suspended.

Jardine District—Fifty stamps are dropping in the Jardine mill, treating daily about 250 tons of sulphide gold ore. This is the largest operating gold mill at the present time in Montana. Jardine is six miles from the north gateway of the Yellowstone National Park.

Cooke City—A fleet of 21 trucks is hauling ore from the Republic company's properties to Gardiner, Mont., where it is loaded on railway cars.

Neihart—An electric hoist has been ordered by the Flohart company. A good ore showing is reported.

Lump Gulch—Ore opened some time ago on the fifth level of the Free Coinage, showing high silver content, is reported to be widening both east and west with drifting operations.

WASHINGTON

Orient—A large oil engine is being installed at the Galena Hill mine to replace the steam equipment now used. A 5-drill compressor is also being added. A raise is being driven at 80 deg. from the 300 level to the surface and when completed will be used as a new central shaft for deeper development work.

ARKANSAS

Big Hurricane Near Pindall To Increase Output—Development To Be Resumed at Lonnie Boy

Rush—The McCargar Mining Co., under the management of D. J. McCargar, has started another opening on a carbonate outcrop on its lease at Rush. The new work is close to the White Eagle line.

Pindall—The Big Hurricane zinc mine near Pindall has been operating steadily this year. J. C. Shepard, the owner, is in charge. Tonnage has been curtailed owing to the low price of ore, but preparations are under way to run at full capacity.

Flippin—Nishwitz Bros. are pushing development work on their property on Bull Mountain, six miles northeast of Flippin, where there is a good face of jack in an open cut. Several thousand tons of mill ore are on the dump. A mill will not be built, however, until development has progressed further.

Rush — Development work at the Lonnie Boy will be resumed at once.

TENNESSEE

Tennessee Copper Experimenting With Underground Mechanical Loaders

Isabella — The Ducktown Sulphur Copper & Iron Co. has almost completed the first 300-ton unit of its new flotation plant at the Mary mine, at which differential flotation is to be used. It is anticipated that, if the grinding mills that have been ordered are received in time, the test run will be made during the autumn.

Copper Hill—The Tennessee Copper & Chemical Corp. has purchased two mechanical loaders for experimental purposes to be used in the Burra Burra mine. One of them, a Myers-Whaley shovel, has already been received and is now at work. The only difficulty noted so far has been that of getting a stope large enough to keep the shovel constantly employed. The other machine is a type O, full-circle-swing Thew shovel with a ⅜-cu.yd. dipper. This has not been delivered yet. The existing shortage of labor is responsible for the company taking this step.

JOPLIN-MIAMI DISTRICT

Oklahoma-Missouri-Kansas

Laclede Lead & Zinc Co. Opens Another Lead Cave

Tar River, Okla.—At the Laclede Lead & Zinc Co.'s property north of Tar River, Okla, one of the largest and richest watercourse lead caves ever discovered in the Oklahoma field is now being worked. With only twenty-nine men the company turned out 100 tons of lead during the last week, virtually all of it coming from this cave. From a spectacular standpoint, the cave is not as beautiful as some others that have been discovered in the Oklahoma field, as the ore is quite generally covered with a sediment. But investigation reveals that the sides and roof are almost solid lead ore. The cavity is approximately 40 ft. wide, 70 ft. long, 8 or 10 ft. high.

MINNESOTA

Mesabi Range

Federal Consolidated Resumes at Ajax —Winston-Dear Stops 300-Ton-Shovel Until Frost

Hibbing—Clement K. Quinn and associates have taken an option on five forties near Nashwauk and adjoining the Shada No. 2 now controlled by them. The property is understood to be a wash proposition owned by the Landon-Warren interests, of Minneapolis, and exploration is now going forward.

The 300-ton shovel operated by Winston-Dear in the Boeing pit of the Mesaba Cliffs Iron Co. has been forced to cease operations because of a pocket of very treacherous muskeg encountered. The shovel will remain in position and resume operation as soon as the frost has made firm footing.

Chisholm—The Billings mine of the Tod-Stambaugh Co. has reduced forces until but ten gangs are now at work. A small shovel is at work loading out last winter's stockpile.

Biwabik—The Federal Consolidated Mining Co. has started to resume operations at the Ajax mine. The Ajax has shipped 207,000 tons of high-grade non-bessemer ore during its career but has been idle for a number of years. A shipment of 25,000 tons is expected during the present season.

Cuyuna Range

Coates & Tweed Purchase Ida Mae Stockpile—Northland Mine Shut Down

Riverton—John A. Savage & Co. has resumed hydraulic stripping of overburden at its Sagamore mine, a manganiferous iron ore property. Following early experiments with the hydraulic giant on starting stripping operations last year this method was abandoned and a contract let for stripping by dragline shovels. A dragline shovel is now being used in loading ore. The overburden includes a heavy covering of muskeg. Plans are being made for erecting a drying plant to treat all ore from the pit.

Ironton—The Cuyuna-Duluth mine, operated by the American Manganese Manufacturing Co., is shipping 8 to 10 cars per day. Slicing above the 280-ft. level is rapidly being completed and drifting and raising on the new 340-ft. level is well advanced. The pump station has been completed and a triplex electric-driven pump installed. Operators are planning to use electric haulage on the new levels. At the instigation of the county mine inspector, G. A. Swanson, the Bonnie Belle mine, operating on the next forty west, is sinking a winze from its 193-ft. level, from which connection will be made to the Cuyuna-Duluth 280-ft. level, improving air and safety conditions.

It is reported that Coates & Tweed of Duluth have purchased the stockpile of the Cuyuna-Minneapolis Iron Co., at its Ida Mae mine and will ship same at once. There is in stock about 18,000 tons of 15-per cent grade manganiferous iron ore, low in moisture and silica. The property is not operating, having pulled its pumps July 17 after small scale operation last year through the past year.

Cuyuna—The Northern Minnesota Ore Co. has suspended operation at the Northland mine, having bulkheaded the drifts and pulled the pumps. The property, opened up for managanese during the war, has not been operated since last fall. The company has recently purchased a high-grade manganese property near Cushman, Ark., from Walter H. Denison and T. F. Snell, and will devote its efforts for the present to continuing hand mining and exploration with a view to possible larger scale operation of the new property. A. K. Knickerbocker, formerly superintendent at the Northland mine, will have charge of the operation of the Arkansas property.

Nearly all operators on the Cuyuna Range report a small shortage of labor, and several of the open pits are seriously handicapped in keeping up their production average.

THE MARKET REPORT

Daily Prices of Metals in New York

Sept	Copper	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
2	18.00@18.35	42.50	45.25@45.50	8.50	8.50@9.00	7.75@7.80
3	18.00@18.35	42.50	45.00@45.50	8 75	8 50@9.00	7.75@7 80
4	18.00@18.35	42.50	45.00@45.50	8.90	8.50@9.00	7.75@7.80
6						
7	18.00@18.35	42.25	45.00@45.25	8.90	8.50@9.00	7.75
8	18.00@18.35	42.00	44.75@45.00	8.90	8.50@9.00	7.75

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction of 0.15c. is made from the "delivered" price, to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
2	95⅛	96⅜	111	269	276	36½	36½	38½	40
3	95¾	97	111	267	274½	36½	36⅝	37¾	39¼
4	....	....	....	....	....	....	....	....	....
6	95¼	96¼	111	267	272½	36¼	36¼	38¼	39¾
7	95	96	111	264½	270½	35½	35½	38½	39¾
8	96½	97¼	111	266	272¾	36¼	36	38¾	40¼

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange	Silver			Sept.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
2	356	99½	93¼	58½	6	....	....	....	60⅜
3	355	99½	94	59	7	354	99½	94½	59½
4	355	99½	94⅞	60⅛	8	353½	99½	94	59

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

On the authority of the Secretary of the Treasury, we quote 100c. per oz. for silver, 1,000 fine, delivered at the option of the Director of the Mint to the New York Assay Office or to the mints in Philadelphia, Denver, or San Francisco, and proved to the satisfaction of the Treasury Department to have been mined, smelted, and refined in the United States. This quotation is retroactive to May 13.

Metal Markets

New York, Sept. 8, 1920

Unusual quietness is the dominating characteristic of the metal market, all the metals apparently feeling the effect of a holiday week. Price changes from the preceding week have been small, and the unimproved London market is still depressing the metal market here. If any improvement is to be noted it was indicated by a slightly improved buying by the copper trade.

In general the buyers are now having their own way, and producers are unable to pass on the increased cost due to recent freight advances.

Just when conditions will improve is hard to say. By some, buying is expected to pick up considerably this month, whereas others feel that no great improvement can be expected until after the November election.

Copper

Sales during the week were recorded at bargain prices, although not in great volume. A somewhat greater interest was shown by the European market, some American copper being bought by Germany. Large tonnages would be hard to obtain under the 18¾@19c. delivered price of the producers, although some shading of prices is likely. Sales were made at 18@18½c. delivered. It is reported that 5,000 to 6,000 tons of copper shell bands are available in London and were offered here at 18½c. delivered. The sale of such metal in this market would be a depressive influence, which may retard the expected buying movement. The statistical position has not been seriously altered, although August sales were among the smallest of the year.

Lead

Practically all of the lead sold last week, except at our average price, was marketed by the A. S. & R. at their contract price of 9c., New York, so that our quoted price, which is based on sales, approaches that figure. The market was exceedingly quiet, and lead could be obtained all week at 8c., New York. In fact, it was slightly weaker than last week. Importations of Tarnowitz and other grades of lead are being made from Germany. Despite the known shortage of supplies in Germany, the country is evidently pursuing the same tactics shown in the silver market several months ago, when large quantities of silver were unloaded upon the market at a time when there was a scarcity of metal.

Producers expect increased production by the gradual return of the miners from the farms, where they gravitated this summer, to the mines. Forward delivery is purely nominal.

Zinc

Prices have shown a slight drop in a dull market and the question of importation of cheaper foreign metal is still an important factor in the situation. The effect of the reduction in price in the American market to meet the lower London prices was to decrease importation. It was reported that only 25 tons of zinc has been imported. An inquiry for 500 tons from France developed during the week, but it was felt that this was merely to "try out" the market, for zinc can be obtained more reasonably in Europe than here.

Tin

The market is "deadly dull," as one consumer has put it. Some buying was recorded at the end of last week, but the decline in London stopped it. Quotations may even vary greatly throughout a single business day, and all out of proportion to the amount of business done. Spot Banca tin has been fairly well cleaned up, and producers of electrolytic report business somewhat better on that account, at fractional discounts over Straits.

Straits tin for future delivery: Sept. 2d, 45.50@46.00c.; 3d, 45.50@46.00c.; 4th, 45.50@46.00c.; 7th, 45.25@45.50c.; 8th, 45.00@45.25c.

Arrivals of tin in long tons: total for August, 5,075; Sept. 1st, London, 25; 2d, London, 25.

Silver

The London market on Sept. 8 declined to 59d., brought about by offerings from the Continent, with limited buying. Cables report sales at a concession under the fixed price of 59d. later in the day. Moderate buying for China, via San Francisco, continues at a small premium over London equivalent. The Mexican government, according to latest advices, continues to purchase silver bullion for coinage at the rate of a million to one and one-half million oz. per month.

Mexican Dollars—Sept. 2d, 71; 3d, 71⅛; 4th, 71⅛; 7th, 71⅛; 8th, 71⅛.

Gold

Gold in London on Sept. 2d, 115s. 1d.; 3d, 115s. 3d.; 6th, 115s. 6d.; 7th, 115s. 6d.; 8th, 115s. 11d.

Foreign Exchange

Foreign money in general declined slightly during the week. Yesterday francs were 6.79c.; lire, 4.29c.; and marks 1.93c. Argentine exchange has depreciated to 85.75c. New York funds in Montreal, 10 7/16 per cent discount. Indian exchange has improved during the week, closing yesterday at 33.25c. per rupee. This should be a favorable influence on silver.

Other Metals

Aluminum—Ingot, 99 per cent and purer, 35.1c.; 98@99 per cent, 34.9c. Virgin metal still obtainable in open market at about 32.5c. for 98@99 grade.

Antimony—Market continues weak. Spot, 7c. per lb.; Cookson's "C" grade, 14@15c. Chinese and Japanese brands, 7c. W. C. C. brand, 9@9½c. [1]Chinese needle antimony, lump, firm at 8@9c. per lb. Standard powdered needle antimony (200 mesh), 10@12c. per lb.

Bismuth—$2.70 per lb., 500-lb. lots, and $2.72 per lb., 100-lb. lots. Market quiet.

Cadmium—Nominal, $1.40@$1.50 per lb. Market steady.

Cobalt—Metal, $3 per lb.; black oxide, $2 per lb.

Iridium—Nominal, $350@$400 per oz. Heavy demand, but small supplies.

Magnesium—Crude, 99 per cent or over pure, $1.75 per lb. for the metal in 100 lb. lots and over, f.o.b. Niagara Falls.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.; Monel metal, shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—Open market, $50@$75 per troy oz.

Palladium—$100@$110 per oz.

Platinum—Firm at $115@$120 per oz.; $105 per oz. in 100 oz. lots.

Quicksilver—Market quiet; $75 per 75-lb. flask. San Francisco wires $75. Barely steady.

Ruthenium—$200@$220 per troy oz.

[1]**Selenium**, black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb. Demand strong.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—$35@$60 per kilogram, according to purity and gage.

Metallic Ores

Bauxite—About 52 per cent alumina content, less than 2 per cent iron oxide, up to 20 per cent silica and artificially dried to contain not more than 4 per cent free moisture, $10 per gross ton at mine; 54 per cent alumina and about 15 per cent silica, $11; averaging 57 per cent alumina, 8 to 12 per cent silica, less than 3 per cent iron oxide, $13 on basis of 8 per cent free moisture. Ores of very low silica content suitable for the manufacture of aluminum oxide and hydrate of alumina command a fancy price.

Chrome Ore—Guaranteed 50 per cent Cr_2O_3 foreign ore with a minimum of 6 per cent silica, 70@80c. per unit, New York. California concentrates, 50 per cent Cr_2O_3 and upward, 70@75c. California production has fallen off, even since May, owing to the low price, which does not permit operation of mines that were worked in 1918 when prices were $1.50 a unit for 50 per cent. The market is strengthening, and should prices rise some abandoned properties will be reopened. There are considerable tonnages of 40 per cent ore at different points in California, which are being held for prices of 50@60c. a unit, f.o.b. cars, California.

Iron Ores—Lake Superior ores, per ton, delivered at Lower Lake ports: Old Range bessemer, $7.45; Old Range non-bessemer, $6.70; Mesabi bessemer, $7.20; Mesabi non-bessemer, $6.55. Congestion at Lake Erie ports due to car shortage has resulted in decreased tonnage. The ore movement is better than at any previous time this season.

Manganese Ore—65@75c. per unit, seaport; chemical ore (MnO_2) $70@$90 per gross ton, lump; $80@$100 per net ton, powdered.

Molybdenum ore—85 per cent MoS_2, 75@80c. per lb. of contained sulphide, New York.

[1]**Tantalum Ore**, guaranteed minimum 60 per cent tantalic acid, 55@65c. per lb. in ton lots, against recent price of 65@70c.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO_3 and over, per unit of WO_3, $7 f.o.b. mines; wolframite, 60 per cent WO_3 and over, per unit of WO_3, $6@$7, in New York.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Vanadium Ore—$1.25 per lb. of V_2O_5 (guaranteed minimum of 11 per cent V_2O_5), New York.

[1]**Zircon**—Washed, iron free, 5c. per lb.

[1]**Zirkite**—$90@$100 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 4.—Zinc blende, per ton, high, $52.90; basis 60 per cent zinc, premium, $48.50@$50; Prime Western, $47.50@$45; fines and slimes, $45@$42.50; calamine, basis 40 per cent zinc, $36. Average settling prices: Blende, $47@$31; calamine, $38.11; all zinc ores, $47.

Lead, high, $111.35; basis 60 per cent lead, $112.50@$110; average settling prices, all grades of lead, $104.90.

Shipments for the week: Blende, 12,040; calamine, 420; lead, 2,050 tons. Value, all ores the week, $800,580.

Platteville, Wis., Sept. 4—Blende, basis 60 per cent zinc, $52 to $52.50 base for high grade. Lead ore, basis 80 per cent lead, $110. Shipments for the week: Blende, 1,116; calamine, 30; lead, 21; sulphur ore, 32 tons. Shipments for the year: Blende, 48,259; calamine, 2,360; lead, 3,921; sulphur ore, 1,241 tons. Shipped during the week to separating plants, 1,910 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $2,400@$3,000; No. 2, $1,400@$1,700; spinning fibres, $400@$800; magnesia and compressed sheet fibres, $325@$400; shingle stock, $110@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax. Freight rate from mines to Sherbrooke, Quebec, over Quebec Central R.R., 20c. per cwt.; from Sherbrooke to New York, 27½c., carload lots; freight to New York for crude No. 1, f.o.b. Thetford mines, $8.45 per ton, carload lots.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, $12 per gross ton; ground (white) $23@$25; ground (off color) $16@$19 per net ton, f.o.b. Cartersville, Ga. Crude, 88 to 94 per cent, $23; ground (white) $40.50; ground (off color) $27 per net ton, less than carload lots, f.o.b. New York. Crude, not less than 98 per cent, $11@$11.25 per ton, f.o.b. cars, Missouri; floated, $28 per ton in bbls.; $26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—Domestic, extra light, 5@6c. per lb.; light, 4½@5½c.; heavy, 4@5c; English, extra light, 5@7c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $9@$12; washed, $12@$15; powdered, $18@$22; bags extra, per net ton, f.o.b. mines, Georgia; crude, $8@$12; ground,

$15@$40, f.o.b. Virginia points. Domestic lump, $10@$20; powdered, $25@$30; imported lump, $25@$35; powdered, $30@$60, f.o.b. New York.

Feldspar—Crude, $8@$18 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$10, f.o.b. Maine; ground, $25@$30 car lots, f.o.b. Baltimore; ground, $17@$20, f.o.b. North Carolina points; $17@$20 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $25 per ton, f.o.b. Illinois mines, and $27.50, f.o.b. Kentucky; ground, suitable for acid, chemical or enameling purposes, $60; lump, $17.50, f.o.b. Tonuco, N. M.

Graphite—Crucible flake, 85 per cent carbon content, 8c. per lb.; 88 per cent, 9½c.; 90 per cent, 10½c., all f.o.b. New York. Crucible grades of Alabama graphite sell as follows, f.o.b. Ashland, Ala.: 80 per cent, 5c.; 90 per cent, 10c. Lubricating grades in increasing demand, with price ranging from 11c. for the 85 per cent guaranteed grade in car lots to 30 and 40c. for higher grades. Mexican, amorphous, $45@$55 per short ton; Korean, 3½c. per lb.; Madagascar, 8c.; Ceylon, 4½@15½c.

Gypsum—Raw crushed rock, $3.50@$4 per ton; raw ground fine, $4@$4.50; calcined stucco, $9, all f.o.b. works. Containers extra. The last price quoted for plaster of paris in carload lots was $4.25 per 250-lb. bbl., f.o.b. mill, alongside dock, New York.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, $1.60@$1.65; 2@8 in., $1.55@$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, $1.65@$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined — High-grade caustic calcined, lump form, $35@$40 per ton, carload lots, f.o.b. California points. Freshly ground calcined, suitable for flooring trade, $75@$85 per ton, f.o.b. Eastern points.

Dead-Burned — $32.50 per net ton, Chewelah, Wash.; $52@$58, Chester, Pa. Austrian grade, $52@$55 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica slightly stained, per lb.: No. 6, 50c.; No. 5, $1.20@$1.40; No. 4, $2@$3; No. 3, $4.25@$5; No. 2, $5.50@$7; No. 1, $8. Clear block: No. 6, 55c.; No. 5, $2; No. 4, $4; No. 3, $5.75; No. 2, $7; No. 1, $9; A1, $14; extra large, $25, all f.o.b. New York; ground, $100@$150 per ton, Philadelphia. Domestic, uncut f.o.b. Franklin, N. C., as follows: Scrap, $45@$50 per ton; punch, 4@5c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., $1.15; 2 x 3 in., $1.65; 3 x 3 in., $2.10; 3 x 4 in., $2.50; 3 x 5 in., $2.75; 3 x 6 in., $3.75; ground 165 mesh, $240 per ton; ground roofing mica, $60; mica washers, 75c.@$2 per lb.; 1¼-in. disks, No. 1, $1.60 per lb.; No. 2, $1.30.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $35 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $13; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $8.35; 68 per cent, $7.85; 68@66 per cent, $7.60. There is no price schedule for spot for domestic uses.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish, fines, per unit 12c., c.i.f. Atlantic seaport; furnace size, 17½c.; run of mine, 12@14c.; domestic, fines, f.o.b. mines, 12@14c.

Quartz—(Acid tower) fist to head, $10; 1¼ to 2 in., $14; rice, $17, all net ton, f.o.b. Baltimore; lump, carload lots, $5@$7.50 net ton, f.o.b. North Carolina mines. F.o.b. Wausau, Wis., the price is $16 per ton in car lots, and $22 less quantities, including bags.

Sulphur—$18 per ton for domestic; $20 for export, f.o.b. Texas and Louisiana mines.

Talc — Paper making, $10@$20 per ton; roofing grades, $9@$15; rubber grades, $10@$15, all f.o.b. Vermont. California talc, $20@$45, talcum powder grade. Southern talc, powdered, carload lots, $15@$20 per ton; less than carload, $25, f.o.b. cars; freight to New York $5.25 per ton, carload lots; less than carload lots, $9.25. Imported, $60@$70; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—White arsenic, 15½c. per lb.; sulphide, powdered, 20@21c. per lb., f.o.b. works, carload lots.

Nitrate—Soda, $3.85 per cwt., ex vessel, Atlantic ports. Market quiet.

Potassium Sulphate—Domestic, $2.25@$2.50 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15 to 18 per cent material, $200@$250 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15. Foreign conditions as affecting the price of American goods remain unchanged.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 17@18c. per lb. of chromium contained; 4 to 6 per cent carbon, 19@20c. f.o.b. works.

Ferromanganese—For 76 to 80 per cent, prompt delivery, $200, freight allowed; last half, $170; English, $170@$175, c.i.f. Atlantic seaports. Spiegeleisen, 18@22 per cent, $80@$85, f.o.b. furnace. Conditions are a little better in California, owing to the opening of a ferromanganese plant there. This plant can, of course, afford to pay a higher price for California ore than can Eastern buyers.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50@$3 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $60@$65; 50 per cent, $82.50@$85; 75 per cent, $150@$160.

Ferrotungsten—70 to 80 per cent W, $1.10@$1.15 per lb. of contained tungsten, f.o.b. works.

Ferro-uranium—35 to 50 per cent U, $7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, $6.50@$9.50 per lb. of V contained, f.o.b. works.

Metal Products

Copper Sheets — Current New York price, 29½c. per lb.; wire quoted, 22½@23c.

Lead Sheets—Full lead sheets, 11c.; cut lead sheets, 12½c. in quantity, mill lots.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 26½c.; sheathing, 25½c.; rods, ⅜ to 3 in., 23½c.

Zinc Sheets—$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, $160 per 1,000, f.o.b. Pittsburgh.

Chrome Brick—$100@$110 per net ton, carload lots, eastern points.

Chrome Cement—40 to 45 per cent Cr_2O_3, $50 per net ton, and $55 in sacks, carload lots, eastern shipping points.

Clay Brick — First-quality fire clay, 9-in. shapes, $55@$60 per 1,000, Pennsylvania, Ohio, and Kentucky works; second quality, $50@$55. First quality, St. Louis, $45; New Jersey, $75.

Magnesite Brick—$110@$120 per ton, eastern shipping points; 9-in. straights, $90@$100; 9-in. arches, wedges and keys, $95@$105; soaps and splits, $110@$120.

Silica Brick—9-in., per 1,000, $56@$61, Birmingham, Ala.; $55@$60, Mount Union, Pa.; $65, Chicago district.

Iron Trade Review

Pittsburgh, Sept. 7, 1920

Pig Iron—There is scarcely any inquiry, even for early deliveries. Furnaces are firm on prices and have well filled order books, at least for the time being. Southern furnaces have held their market to the basis of $42, Birmingham, attained at the end of last April, and thus there is the anomalous condition that, even with the advanced freight rates, Southern iron is cheaper delivered Pittsburgh than Valley iron, the new Birmingham-Pittsburgh rate being $7.60. Valley iron remains quotable at $50 for foundry and malleable and $48.50 for bessemer and basic, the new rate to Pittsburgh being $1.96.

Steel—Standard billets have sold at $60, Pittsburgh, which seems to be an established market. Sheet bars are $67.50@$70, Pittsburgh or Youngstown, both markets being quiet.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 6c. per lb., in 250-lb. bbls.

Connellsville — Furnace, $17@$18; foundry, $18@$20.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

The Unusual Lead Situation

St. Louis Market Ruling Above New York, a Condition Duplicated in 1916—Domestic Production Failing To Increase To Relieve the Lead Shortage—France Developing Her Own Lead Resources

THE present abnormal relation between the St. Louis and New York lead market is due to exceptional circumstances and is a condition that rarely arises. In fact, the only similar occasion in recent years was recorded in the spring of 1916, when the St. Louis lead price ruled higher than the New York quotation. This instance, however, differed radically from the present one, and was due primarily to a very large demand for export lead from the Orient, buyers being willing to pay prices high enough to justify shipments of lead from Omaha and St. Louis to Pacific Coast points. Consequently the St. Louis market was placed on equal terms with New York, and to compete for the Asiatic export trade the New York price necessarily was lowered to allow for the freight differential from New York points to St. Louis.

The Difference Between the 1916 and 1920 Markets

The present situation is in marked contrast to the one prevailing in 1916 and is due to lead coming into the United States—not leaving it—plus an acute domestic shortage of prompt lead supplies. Expressed differently, the combination of demand and supply for spot lead is so strong, and has been for weeks, that domestic producers have been unable to fill requirements and have therefore had to allow foreign lead of Mexican, English, Spanish, and Australian brands to come into the country. This importation would have been unprofitable were it not for the low London metal market quotations by which lead can be laid down in New York, duty paid, from 8.00c. to 8.50c. per lb. to compete with domestic lead. Naturally, if there is a scarcity of lead in the Middle West, imported lead which is used for Western requirements must stand the freight charge to the West, and hence rule correspondingly higher in price, in Western districts.

Protection of the Lead Industry

Of all the major metals pig lead has the greatest tariff protection, with an ad valorem duty of 25 per cent. Raw copper is admitted free, and imported metallic zinc must shoulder a duty of 15 per cent. Yet in spite of the comparatively splendid protection rendered the domestic industry, it is paying importers to buy lead in London, and pay the commission, delivery, insurance, transatlantic freight, lighterage, loss of interest and miscellaneous charges. This condition is most unusual.

There can be no complaint about the price of lead. Compared with a pre-war price of 4.5c., which was considered satisfactory at the time, 9c. lead is highly remunerative, particularly when the price is considered in relation to the deflated prices of other metals.

Why the London Market Has Not Responded

The failure of the London market to rise only slightly to meet that of New York is a singular feature of the situation, and is ascribed to a number of conditions, but principally to the lack of demand in England and on the Continent—a direct contrast to the eagerness with which supplies of lead are utilized in this country. Also a little give-and-take element is introduced in the delivery of American lead to England on old contracts. Furthermore, there is the influx of Spanish lead in England, material which formerly found its way to France. The latter country is evidently trying to become independent of Spanish lead resources, and it is reported that the Escalette works are drawing raw material from Morocco in preference.

It should be noted in connection with the imported lead that about 75 per cent of the lead consumed in the United States is based on average-price and sliding-scale contracts and only the excess requirements are filled by imported lead, or contract requirements which cannot be met because of a shortage of domestic supplies.

Labor's Attitude

The summer and fall seasons are always trying upon the mining operations of the country, as labor has a tendency to migrate to the farms and harvest fields, where the wages are, in these days, better than in the mines and where a more healthful occupation can be followed. Practically all the lead producers are complaining about this attitude on the part of labor, and no doubt could speed up production greatly if they had a representative share of workers. A solution to this pressing problem of mine operation, which recurs yearly in periods of agricultural prosperity, would be most welcome.

The Lead Ore Reserves

In connection with the decreased production in the United States, it is pertinent to consider if there is not some basic reason underlying this broad trend in the industry other than labor and transportation embarrassments, and if it may not be that the domestic resources are smaller than has been assumed and whether a pinch of easily worked reserves is not actually being felt. Glancing at production figures for the last few years, it is noticeable that the great lead-producing centers in the United States, southeastern Missouri, Idaho, Utah, and Colorado, were easily able to meet the intense war demand, and, in fact, have readily responded to conditions in the industry, and give the impression of being highly flexible in productive capacity. It has only been in the last year that production has failed to keep pace with demands placed upon it.

Even though the figures indicate that nothing is inherently wrong with the lead reserves of the country, it is interesting to consider the contrasted position of the large copper deposits, with well-developed reserves, and those of lead. Lead deposits are not gigantic low-grade occurrences, and the success of a lead-mining enterprise often hinges upon a metallurgical ability to separate the closely related metal, zinc, from the ore. Flotation and improvements in the treatment of ores have worked wonders in increasing available lead and zinc reserves throughout the world. Furthermore the lead bonanzas have been worked out, and it is becoming increasingly more costly—leaving aside the question of present high labor and supply cost—to produce lead.

Australian and Spanish Difficulties

The settlement of the Broken Hill strike should soon bring increasing quantities of lead upon the market, but the full effect of Australian production will not be felt for some time.

The low level of the London market is undoubtedly working a hardship upon the producers in Australia and also in Spain, who find it difficult to lay down lead in London at a profit, when quotations around £36 per ton are ruling, especially when the serious labor troubles in these countries are considered. In the United States there is a shortage of lead supplies; in Europe there is more than enough to supply present requirements, and yet the London and New York markets have failed to strike a balance. It is a peculiar world situation.

Illustrating the great consumption of lead that is taking place in other than paint and storage-battery manufacture, it is interesting to note the lead consumption of the Western Electric Co. in telephone apparatus during the year ending June 30, 1920, which amounted to 100,000,000 lb. The Western Electric Co. produces practically 95 per cent of the world's transmission apparatus at one of its plants near Chicago.

COMPANY REPORTS

Consolidated Interstate-Callahan Mining Co. Preparing for Increased Output

Lead-Zinc; Idaho

The report of operations of the Consolidated Interstate-Callahan Mining Co. for the second quarter of 1920 follows:

Net value of shipments	$384,162.64
Miscellaneous receipts	2,234.76
Total income	$386,397.40
Production costs, expenses, taxes	341,650.54
Profits	$44,746.86
Cost of improvements	9.00
Surplus for the period	$44,737.86

The principal features of the mining and milling operations during the quarter were as follows:

Tonnage mined	51,074
Tons of mine ore milled	37,534
Average contents of ore milled:	
Zinc	14.67%
Lead	6.91%
Silver	2.27 oz.

Shipments	Tons	Zinc Assay, per Cent	Lb. Zinc	Lead Assay, per Cent	Lb. Lead
Zinc ore, crude	175	53.81	188,347	2.19	7,682
Zinc concentrates	8,037	52.13	8,379,539	3.36	539,938
Lead ore, crude	70	6.02	8,428	65.46	91,647
Lead concentrates	3,116	13.23	824,261	57.95	3,611,780
	11,398		9,400,575		4,251,047

Total recovery of zinc	38.85%
Total zinc in zinc crude and zinc concentrates shipped	8,567,885 lb.
Total lead in lead crude and lead concentrates shipped	3,703,427 lb.
Ounces of silver in lead crude and lead concentrates	61,825 oz.
Cost of mining, crushing, and sorting, per ton mined	$4.456
Cost of milling and flotation royalties, per ton milled	$2.511

During the second quarter shipments of zinc and lead-silver ore and concentrates were 4,576 dry tons less than the preceding quarter. This falling off is accounted for by the scarcity of miners and by a lack of efficiency on the part of labor in general.

Since the last report, the company has consummated the purchase of a controlling interest in the Chicago-Boston Mining Co. and also in the Killbuck Mining Co., both of which are lead-silver properties; the former owning approximately 280 acres and the latter 100 acres, about 1½ miles from Wallace, in the Coeur d'Alene mining district, Idaho. The work of opening up the orebodies at depth in these properties is being actively prosecuted preparatory to shipments on a large scale. The acquisition of the above properties required a considerable outlay in cash, which has been appropriated from surplus funds, so that no new financing was necessary.

Mount Morgan Gold Mining Co. Reserves, 3,437,687 Tons

Gold; Queensland, Australia

The Mount Morgan Gold Mining Co., Queensland, Australia, raised 147,510 tons of ore during the half-year ended May 30, 1920. Of the total, 52,293 tons was smelting, 93,710 tons concentrating, and 1,507 tons leaching ore. Reserves were depleted by 100,517 tons, leaving the estimate as on May 30 at 3,437,687 tons containing 2.59 per cent copper and 6.11 dwt. of gold per ton. In addition to the ore 3,685 tons of fireclay, 2,410 tons of silica, 794 tons of siliceous ore containing 9.42 dwt. of gold per ton, 25,635 tons of limestone, and 8,594 tons of ironstone were raised by the company for its own use.

The mill treated 91,818 tons of ore, assaying 2.0 per cent Cu and 5.52 dwt. Au per ton, producing 8,522 tons jigged concentrates (2.31 per cent Cu; 4.65 dwt. Au); 19,427 tons table concentrates (2.62 per cent Cu; 8.82 dwt. Au); 7,023 tons flotation concentrates (14.49 per cent Cu; 25.98 dwt. Au); and 1,479 tons of leaching product (2.17 per cent Cu; 5.64 dwt. Au).

At the smelting works, 87,580 tons of ore and concentrates were treated, comprising 53,461 tons crude ore, 8,887 tons jigged concentrates, 21,459 tons table concentrates, 1,560 tons crude ore from Many Peaks, 2,016 tons calcines from Many Peaks, 159 tons purchased ore, and 38 tons of precipitates. From this material 3,130.55 tons copper (3.58 per cent), and 39,387 oz. gold (8.99 dwt. per ton) were recovered. The gold, however, included 181.68 oz. from silica linings, the tonnage of which was not included.

Blister copper sold during the term brought £503,357, and sundry income £1,458. Working expenses totaled £405,255, leaving £99,560 to be carried to profit-and-loss account. Of this, £38,482 remained as net profit after provision for the usual items, and the total available, after adding £153,710, brought forward from previous account, was £192,192. Two dividends absorbed £100,000 and the balance, £92,192, was carried to balance sheet. Liquid assets were £487,933 in excess of liabilities, as against £543,732 at the beginning of the term.

Barnes-King Development Co. Second-Quarter Earnings, $20,219

Gold-Silver; Montana

The records of the Barnes-King Development Co. show the following operating results for the quarter ending June 30, 1920:

Earnings		
Shannon property operations		$16,005.89
Piegan-Gloster property operations		7,901.05
Kendall property operations		699.70
Interest received		775.03
		$25,381.67
Deduct		
Loss on operations at North Moccasin property	$2,985.85	
Miscellaneous expense	1,824.60	
Capital stock tax	346.50	
Black Hawk option	5.00	
		5,161.95
Balance, being net profit on operations for quarter ending June 30, 1920		$20,219.72

The above figures include provisions for depreciation on the various plants of the company on the same basis as has been used heretofore.

Production from the North Moccasin property amounted to $36,469.33 from 3,768 tons of ore, or $9.68 per ton. Development work, 605 ft. The North Moccasin production has been decreasing for some time, owing to unsuccessful search for new orebodies, and the present outlook at this property is discouraging, with operations being continued at a heavy loss.

Production from the Piegan-Gloster property amounted to $35,447.85 from 2,661 tons of ore, or $13.32 per ton. During the latter part of May, a larger flow of water than anticipated from the bottom workings of this property made it necessary to take out the remaining pay ore in the winze as fast as possible and pull the pumps and equipment, or take the chance of drowning them by trying to continue work. The former plan was adopted, which practically closed the mine for the present, and future work has not been decided on.

Production from the Shannon property amounted to $69,084.07 from 7,009 tons of ore, or $9.86 per ton. Development work, 1,048 ft. The Kendall lessees paid in royalties $548.36 during the quarter.

Dividend No. 14, of $20,000, 5c. per share, was payable on Aug. 16, 1920, to stockholders of record July 26, 1920. This disbursement makes total dividend payments $440,000.

MINING STOCKS

Week Ended September 4, 1920

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Adventure	Boston	...	...	*50		
Ahmeek	Boston	57¾	57	57	June '20, Q	.50
Alaska-B.C.	N. Y. Curb	1 1/16	15/16	1		
Alloues	Boston	25	23	25	Mar. '19,	1.00
Anaconda	N. Y.	55⅜	52¼	54⅞	Aug. '20, Q	1.00
Ariz. Com'l	Boston	10¼	9⅛	10¼	Oct. '18,	.50
Big Ledge	N. Y. Curb	⅛	3/16	⅛		
Bingham Mines	Boston	8¼	8⅛	8⅛	Sept. '19, Q	.25
Calumet & Ariz.	Boston	56¼	55¾	56	June '20, Q	1.00
Calumet & Hecla	Boston	290	281	285	June '20, Q	5.00
Canada Copper	N. Y. Curb	⅛	3/16	7/16		
Centennial	Boston	10	9⅞	9¾	Dec. '18, SA	1.00
Cerro de Pasco	N. Y.	44	38½	43	June '20, Q	1.00
Chief Consol.	Boston Curb	3¼	3	3¼	Feb. '20, Q	.10
Chile Copper	N. Y.	15⅝	14	15¼		
Chino	N. Y.	30⅜	27⅞	29⅛	June '20, Q	.37½
Columbus Rexall	Salt Lake	*39	*37½	*38½		
Con. Ariz	N. Y. Curb	...	...	5/16	Dec. '18, Q	.05
Con. Copper M	N. Y. Curb	2⅜	2⅛	2⅛		
Copper Range	Boston	35⅛	34	35⅛	June '20, Q	.50
Crystal Copper	Boston Curb	*40	*35	*36		
Davis-Daly	Boston	7⅛	7	7⅛	Mar. '20, Q	.25
East Butte	Boston	11	10½	11	Dec. '19, A	.50
First Nat'l	Boston Curb	*75	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2⅜	2	2½		
Gadsden Copper	N. Y. Curb	...	...	*71		
Granby Consol	N. Y.	36⅜	34½	36⅜	May '19, Q	1.25
Greene-Cananea	N. Y.	27¼	25	27¼	Aug. '20, Q	.50
Hancock	Boston	4	4	4		
Houghton	Boston Curb	...	...	*40		
Howe Sound	N. Y. Curb	3⅜	3⅛	3⅜	July '20, Q	.05
Inspiration Con.	N. Y.	48	45¼	48	July '20, Q	1.00
Iron Cap	Boston Curb	9	9	9	Feb. '19, M	.25
Isle Royale	Boston	28	27¼	28	Sept. '19, SA	.50
Kennecott	N. Y.	26	23⅞	25⅞	June '20, Q	.50
Keweenaw	Boston	...	...	1½		
Lake Copper	Boston	3	3	3		
La Salle	Boston	...	...	2½		
Magma Chief	N. Y. Curb	...	...	*21		
Magma Copper	N. Y. Curb	27¼	27	27⅛	Jan. '19, Q	.50
Majestic	Boston Curb	*13	*13	*13		
Mason Valley	N. Y. Curb	...	...	2⅛		
Mass. Con	Boston	3	3	3	Nov. '17, Q	1.00
Mayflower-O.C.	Boston	6½	5½	6¼		
Miami	N. Y.	20	17⅞	19⅞	Aug. '20, Q	.50
Michigan	Boston	4	3⅜	4		
Mohawk	Boston	60	56⅜	60	Aug. '20, Q	1.50
Mother Lode (new)	N. Y. Curb	6	5⅛	5⅞		
Nevada Con	N. Y.	11½	10⅜	11⅛	June '20, Q	.25
New Arcadian	Boston	...	...	2½		
New Baltic	Boston Curb	...	...	3		
New Cornelia	Boston	18	16¾	17⅜	Aug. '20,	.25
Nixon Nev.	N. Y. Curb	...	...	*9		
North Butte	Boston	17	15½	16⅜	Oct. '18, Q	.25
North Lake	Boston	...	...	⅛		
Ohio Copper	N. Y. Curb	...	...	1/16		
Osceola	Boston	41	41	41	June '20, Q	.50
Phelps Dodge	Open Mar.	†195	†180	...	July '20, Q	2.50
Quincy	Boston	44½	43½	44½	Mar. '20, Q	1.00
Ray Con	N. Y.	16⅜	14⅜	16½	June '20, Q	.25
Ray Hercules	Boston Curb	*63	*63	*63		
St. Mary's M. L.	Boston	38½	38½	38½	June '20, K	2.00
Seneca	Boston	15½	14½	15		
Shannon	Boston	1⅛	1⅛	1⅛	Nov. '17, Q	.25
Shattuck Ariz.	N. Y.	9	8¼	9	Jan. '20,	.25
South Lake	Boston	...	...	2		
South Utah	Boston	...	...	*15		
Superior	Boston	5	4	5	Apr. '17,	1.00
Superior & Boston	Boston	4⅛	3⅜	4⅛		
Tenn. C. & C.	N. Y.	9⅛	9¼	9⅜	May '18, I	1.00
Tuolumne	Boston	*60	*55	*58	May '13,	.10
United Verde Ex.	Boston Curb	30⅞	30	30⅞	Aug. '20, Q	.50
Utah Con.	Boston	6⅜	6¼	6⅜	Sept. '18,	.25
Utah Copper	N. Y.	64⅛	61	64	June '20, Q	1.50
Utah M. & T.	Boston	1⅜	1⅛	1⅛	Dec. '17,	.30
Victoria	Boston	...	...	1⅛		
Winona	Boston	*25	*25	*25		
Wolverine	Boston	13	12¾	13	Jan. '20, Q	.50
LEAD						
Hecla	N. Y. Curb	4⅛	4⅛	4⅛	June '20, QX	.20
St. Joseph Lead	N. Y.	17	16⅞	17	June '20, QX	.50
Stewart	Boston Curb	...	...	*16	Dec. '15,	.05
Utah Apex	Boston	...	...	1⅜	Nov. '18,	.25
ZINC						
Am. Z. L. & S.	N. Y.	12¾	11¾	12¾	May '17,	1.00
Am. Z. L. & S. pf.	N. Y.	...	...	44½	Aug. '20, Q	1.50
Butte C. & Z.	N. Y.	7⅜	6⅞	7⅜	June 18, I	.50
Butte & Superior	N. Y.	20⅛	18⅝	20	Sept. '17,	1.25
Con. Interst. Cal.	N. Y.	10⅛	9⅞	10⅜	June '20, Q	.50
New Jersey Z.	N. Y. Curb	184	176	182½	Aug. '20, Q	4.00
Success	N. Y. Curb	*4½	*4	*4	July '16,	.03
Yellow Pine	Los Angeles	*95	*95	*95	June '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	N. Y.	1⅜	1¼	1⅜		
Alaska Juneau	N. Y.	1⅜	1⅛	1⅜		
Carson Hill	N. Y. Curb	...	...	24⅜		
Cresson Consol. G.	N. Y. Curb	1	3/4	7/8	June '20, Q	.10
Dome Ex.	Toronto	*38½	*36½	*37½		
Dome Mines	N. Y.	11⅜	11⅛	11⅜	July '20, Q	.25
Golden Cycle	Colo. Sprgs.	‡...	...	*73	May '20, Q	.02
Goldfield Con.	N. Y. Curb	*10	*8⅝	*10	Dec. '19,	.05
Hedley	Boston	...	...	4¼	June '19,	.10
Hollinger Con.	Toronto	5.80	5.74	5.74	Aug. '20, BM	.05
Homestake	N. Y.	...	...	50	Sept. '19,	.50
Kirkland Lake	Toronto	*52½	*52	*52		
Lake Shore	Toronto	1.15	1.13	1.15	Oct. '19,	.02½
McIntyre-Porcupine	Toronto	1.98	1.93	1.94	May '20, K	.05
Porcupine Crown	Toronto	....	...	*26½	July '17,	.03
Portland	Colo. Sprgs.	‡...	....	*60	July '20, Q	.01½
Reorgan. Booth	N. Y. Curb	5	4	4½	May '19,	.05
Silver Pick	N. Y. Curb	*7	*5½	*7		
Teck Hughes	Toronto	...	...	*8		
Tom Reed	Los Angeles	1.08	1.04	1.07	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅞	2⅜	2⅛	Apr. '20, Q	.21
Vindicator Consol.	Colo. Sprgs.	‡...	...	*18	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6½	*6½	*⅛		
White Caps Min.	N. Y. Curb	*8½	*7⅜	*8		
Yukon Gold	Boston Curb	...	...	1¼	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*19	*15	*17	Apr. '20, M	.03
Beaver Con.	Toronto	*42	*40	*40½	May '20, K	.03
Coniagas	Toronto	....	....	2.55	Aug. '20, Q	.12½
Crown Reserve	Toronto	....	....	*24½	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	Sept. '19,	1.00
La Rose	Toronto	*33½	*33½	*33½	Apr. '18,	.02
McKinley-Dar.	N. Y. Curb	...	...	*55	July '20, Q	.03
Mining Corp.	Toronto	1.75	1.70	1.70	June '20, Q	.12½
Nipissing	N. Y. Curb	10	9¼	9⅞	July '20, Q	.25
Ontario Silver	N. Y.	5⅛	5	5⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	⅜	⅜	5/16	Jan. '12,	.10
Peterson Lake	Toronto	...	...	*13½	Jan. '17,	.01½
Temiskaming	Toronto	*33	*33	*33	Jan. '20, K	.04
Trethewey	Toronto	*27	*25	*25	Jan. '19,	.05
GOLD AND SILVER						
Atlanta	N. Y. Curb	*2	*1½	*2		
Barnes-King	Butte	‡...	....	1.11	Aug. '20, Q	.05
Bost. & Mont.	Poston	...	...	*63		
Cashboy	N. Y. Curb	*7⅛	*7	*7⅛		
El Salvador	N. Y. Curb	1⅜	1⅛	1⅜		
Jim Butler	N. Y. Curb	*15	*13	*14½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5½	*4½	*5	June '16,	.05
Louisiana Con.	N. Y. Curb	⅛	1/16	⅛		
MacNamara M.	N. Y. Curb	¼	1/16	¼	May '10,	.02½
N.Y. Hond. Rosar	Open Mar.	†12½	†10½	...	July '20, QX	.50
Tonopah-Belmont	N. Y. Curb	1⅛	1⅛	1⅛	Jan. '20, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	1⅛	1⅛		
Tonopah Ex.	N. Y. Curb	1⅜	1⅜	1⅜	July '20, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1⅜	Oct. '19, SA	.15
West End Con.	N. Y. Curb	1⅛	1⅛	1⅛	Dec. '19 SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*21	*19	*20	July, '20, M	.01
Consol. M. & S.	Montreal	25½	25	25	July '20, Q	.62½
Daly Mining	Salt Lake	....	....	2.50	July '20, Q	.10
Daly-West	Boston	4⅛	4⅛	4¼	July '20, Q	.25
Eagle & Blue Bell	Boston Curb	...	...	2 1/16	Apr. '20, Q	.10
Electric Point	Spokane	*30	*29	*30	May '20, SA	.03
Fed. M. & S.	N. Y.	...	...	10	Jan. '09,	1.50
Fed. M. & S. pf.	N. Y.	33	32½	32½	June, '20, Q	1.75
Florence Silver	Spokane	*35	*35	*35	Apr. '19,	01½
Grand Central	Salt Lake	....	....	*37½	June '20, K	.03
Iron Blossom	N. Y. Curb	1/16	1/16	⅛	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	...	...	3.97½	July '20, Q	.12½
Marsh Mines	N. Y. Curb	*17	*14	*16		
Prince Consol.	N. Y. Curb	1/16	1/16	1/16	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*13	*13	*13	Feb. '19,	.01
Rex Con.	N. Y. Curb	*6	*5	*6		
South Hecla	Salt Lake	*96	*95	*95	Sept. '19, K	15
Stand. S. L.	N. Y. Curb	¼	1/16	¼	Oct. '17,	.05
Tamarack-Custer	Spokane	2.35	2.25	2.35	Dec. '19, K	.03
Tintic Standard	Salt Lake	3.45	3.32½	3.32½	June '20, Q	.10
Wilbert	N. Y. Curb	*4	*3	*3½	Nov. '17,	.01
NICKEL-COPPER						
Internat'l Nickel	N. Y.	20¼	19⅛	19⅛	Mar. '19,	.50
Internat'l Nick.pf.	N. Y.	...	...	80¾	Aug. '20, Q	1.50
QUICKSILVER						
New Idria	Boston	....	....	5	Jan. '19,	.25
TUNGSTEN						
Mojave Tungsten	Boston Curb	*10	*10	*10	...	...
VANADIUM						
Vanadium Corp.	N. Y.	70⅜	66½	70	July '20, Q	1.50
ASBESTOS						
Asbestos Corp.	Montreal	86	85	85½	July '20, Q	1.50
Asbestos Corp. pf.	Montreal	97	94	94	July '20, Q	1.75
MINING, SMELTING AND REFINING						
Am. S. & R.	N. Y.	61	55¼	60	June '20, Q	1.00
Am. S. & R. pf.	N. Y.	90⅝	90⅝	90⅝	June '20, Q	1.75
Am. Sm. pf. A.	N. Y.	73¼	72	73¼	July '20, Q	1.50
U. S. Sm. R. & M.	N. Y.	57	53½	57	July '20, Q	1.50
U.S.S.R.& M. pf.	Boston	44	43¼	44	July '20, Q	.87½

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, bimonthly. K, Irregular. I, Initial. X, includes extra

INDUSTRIAL NEWS

International Minerals & Metals Corporation is the new name under which Beer, Sondheimer & Co. Inc., 61 Broadway, N. Y., have recently incorporated. The management and relationship to affiliations and subsidiaries have not been affected and will continue as heretofore.

Pennsylvania Pump & Compressor Co., Easton, Pa., has opened additional sales offices at 788 Potomac Ave., Buffalo, N. Y.; 232 St. Clair Ave., N. E., Cleveland, Ohio; 1956 N. Broadway, St. Louis Mo.; 423 Fifth St., S., Minneapolis, Minn.; and 804 First Nat. Bank Building, Omaha, Neb.

W. A. Olen, president, with **D. J. Rohrer** and **C. F. Folkman**, members of the board of directors of the Four Wheel Drive Auto Co., Clintonville, Wis., sailed for England on Aug. 14. They will study the truck situation with a view to improving present facilities of the company for handling its increasing export trade.

Technical Advertising Service, 1133 Broadway, New York, announces the election of Raymond Hawley as vice-president. Mr. Hawley, who has had much experience as advertising, sales and production manager, was last with Keystone Motor Truck Corporation, of Philadelphia, Pa.

Uehling Instrument Co., 71 Broadway, New York, manufacturers of fuel economy equipment, announces that its New England States representative is the Smith Engineering & Supply Co., 89 State St., Boston, Mass.

H. K. Lidstone and **G. H. Van Dorp**, mining and metallurgical engineers, have opened an office at Texas and Yankie Sts., Silver City, N. M. Their postoffice address is Box 216.

The General Briquetting Co., 25 Broad Street, New York City, announces the appointment of Thomas F. Kelly, formerly with the Lackawanna Steel Co., as Sales Engineer in its flue dust, ore and byproducts department.

Worthington Pump & Machinery Corporation, 115 Broadway, New York City, announces that it is ready to furnish improved waterpower machinery of all capacities for low, medium, and high head service.

A. B. Way, recently secretary and general manager of Bridgeport Chain Co., has become New England District Sales Manager for Chain Products Co., of Cleveland, Ohio. His headquarters will be 150-152 Chambers St., New York City.

Julius Janes, former president of Standard Steel Castings Co., is sales representative of Farrell-Cheek Steel Foundry Co., Sandusky, in Cleveland and Cuyahoga County, Ohio.

Blaw-Knox Co., steel products, Pittsburgh, Pa., announces that DeWitt Clinton Grove, formerly in charge of the advertising for an Ingersoll-Rand subsidiary and past vice-president of the Technical Publicity Association, has become its advertising manager, vice George Land, resigned.

Industrial Information Bureau for China

Of interest to those who do, or desire to do, business in China is the announcement that beginning with February, 1921, the Government Institute of Technology at Shanghai, China, will open a bureau of information for alumni. The school is under Chinese government support and turns out engineer and railway administration men with a technical education equivalent to that of an American engineering school. These men often are situated away from the port cities, and find it difficult to obtain desired information regarding equipment. To meet this need the school is about to open this bureau. Manufacturers who are interested are invited to send catalogs, specifications, designing data, approximate costs, samples, or models. In case samples are sent an attempt will be made to place same in running order. No sales will be made nor attempted. Impartial information alone will be offered. A member of the faculty is now in America on leave, and he will be glad to communicate further with any who desire information regarding the China field. Address H. A. Vanderbeek, 5 Cammann Place, Somerville, N. J., until Dec. 1, 1920, and Box 951 United States Post Office, Shanghai, China, after that date.

American Welding Society Organizes a Chicago Section

At a meeting of members of the welding trade in Chicago, held in the rooms of the Western Society of Engineers, on Tuesday, Aug. 3, a Chicago Section of the American Welding Society was organized. About seventy-five were in attendance, representating many railroads terminating in Chicago and also many of the larger local industries. The following officers and directors were elected: Chairman, M. B. Osburn, assistant superintendent, Pullman Car Works; vice-chairman, O. T. Nelson, president, General Boilers Co.; secretary-treasurer, L. B. Mackenzie, president, *The Welding Engineer;* directors: three years, E. Wanamaker, H. B. Bently, Andrew Oliver, W. M. B. Brady; two years, Harold Cook, W. A. Slack, K. R. Hare, J. M. Jardine; one year, W. H. Bleecker, Jr., Oliver Mitchell, W. L. Senhert, Don B. McCloud.

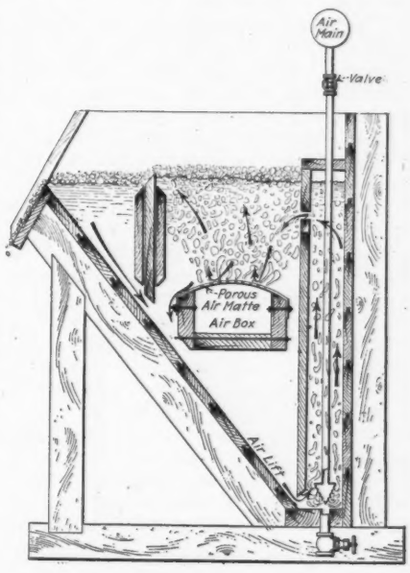
Meetings will be held on the second Tuesday of each month in the rooms of the Western Society of Engineers, and those interested in the subject of autogenous welding, by all methods, are invited to attend. The address of the secretary-treasurer is 608 South Dearborn St., Chicago.

The Simpson Flotation Cell

Has No Mechanical Parts—May Be Safely Shut Down Under Full Load —Will Not Clog

BY S. FORD EATON

The Standard pneumatic flotation cell, invented and manufactured by Gerald R. Simpson, of Kingman, Ariz., operates entirely on the pneumatic principle. Air lifts are employed to circulate the pulp, continually feeding it to an agitation compartment where compressed air, admitted through a porous medium or spray, is employed to produce the froth. The froth is under positive control by the adjustment of the volume and pressure of air admitted to the agitation compartment, and by adjustment of the baffle board. By means of these adjustments, a deep or a shallow froth can be carried, as may be desired. After passing over the



STANDARD PNEUMATIC FLOTATION CELL INVENTED BY G. R. SIMPSON

baffle board, the froth must cross a spitzkasten of quiet water before being discharged over the overflow lip into the concentrate launder, and thus much of the gangue matter which has been mechanically entangled in the froth is given an opportunity to settle, thereby securing a cleaner concentrate than otherwise. The control which is thus exercised over the depth and the rapidity of discharge, or overflow, of the froth, results in a high percentage of recovery and a high-grade concentrate.

By means of a series of vertical and inclined partitions, the bottom of the cell is converted into a number of hoppers, whose walls converge to a central point at the bottom of the air lifts. The pulp is thus conveyed progressively from one air lift to another, being submitted by each to the agitating compartment. The floating particles are thus given a number of opportunities to engage with an air bubble and be carried into the froth before reaching the discharge compartment.

Commercial machines of from 50 to 100 tons daily capacity are equipped with six to eight air lifts, each of which treats the entire pulp twice before it is discharged.

Clogging, which has been a serious drawback to other air machines, has been entirely eliminated by means of an improved air injector at the bottom of the air lift and the conical shape, or converging walls, of the respective hoppers or compartments. The machines may be closed down while containing a full charge of pulp for twenty-four hours or longer, and again placed in operation merely by turning on the air. From 2 to 3-lb. pressure is sufficient for the operation of these machines.

The discharging device, when once set, is automatic, and, working in conjunction with an overflow weir, maintains the water at a constant point, which is determined by the adjustable position of the weir.

The Standard pneumatic cell was developed at the property of the Standard Minerals Co., near Kingman, Ariz., where a molybdenite ore was being treated.

An interesting problem has also been solved at the Diamond Joe Silver mine, near Yucca, Ariz., by the use of Mr. Simpson's invention. A silver chloride and bromide ore containing some lead sulphide is being sulphidized and floated. Satisfactory extraction is being secured with concentrates carrying 500 oz. of silver and from 30 to 45 per cent of lead. The principal tailing loss occurs in the slime and can be somewhat reduced under more favorable grinding and sulphidizing conditions.

Mr. Simpson's invention was prompted by his desire to get away from the expensive shutdowns experienced at his mill on account of some of the parts of the mechanically-agitated machine that he was using becoming out of order. In departing from mechanical agitation entirely, he eliminated this difficulty, as the only part of his machine which could possibly cause a shutdown is the porous air mat. This seldom requires adjustment, but in any event can be changed in ten minutes.

Shop Workers Get Leave With Pay

Four thousand shop employees of the Western Electric Co. will receive a vacation with pay this summer for the first time in the history of the company. The board of directors has promulgated an order extending the vacation privilege to every department. Previously, factory workers did not receive the same benefit as the members of the sales, clerical, technical and executive branches, and any time off during the summer months was taken at their own expense. The fact that they received pay on an hourly basis with extra rewards for overtime always counted against granting them the same privileges as the weekly salaried body, the members of which get no remuneration for additional labor. The new ruling is a radical change in factory practice.

An American Gold Dredge for New Zealand Fields

An example of the far-reaching activities of American industry is to be found in a gold dredge that has been designed and constructed in New York State for the purpose of operating in New Zealand gold fields. This dredge is being built by the New York Engineering Co. and is along the type of dredge constructed for operations in Alaskan fields. The hull is 115 ft. 6 in. over all, beam 50 ft., depth 11 ft., and is built of kaurice pine. Power for dredging, pumping, and shifting position is furnished by Westinghouse electric motors. Twelve men, four men to a shift, constitute the crew. A winch motor is used to change the position of the dredge.

The digging ladder carrying the buckets is 100 ft. long and weighs 110,000 lb. There are 73 buckets, each bucket weighing 3,000 lb. empty and with a load capacity of about 10½ cwt. When in operation, dredging is at the rate of 18 buckets per minute, and a linear speed of 54 ft. per minute is obtained from a 200 hp. slip-ring motor with a magnetic controller for reversing and 50 per cent speed reduction.

The screen is 40 ft. long and 7 ft. in diameter and weighs approximately 6,500 lb. A 50-hp. slip-ring motor operates this screen at seven revolutions per minute.

About 8,000 gal. of water per minute are used in washing, and the three pumps (the high pressure, low pressure, and nozzle pump) are driven by Westinghouse squirrel-cage motors of 125, 60 and 25 hp., respectively.

The conveyor belt transferring dirt from the screen to the stacker is 42 in. wide and 130 ft. long, and the stacker is operated by a 40-hp. slip-ring motor. Winch drive is furnished by a 25-hp. slip-ring motor, and a 10-kw. transformer is used for lighting purposes. All motors are of the three-phase, 60-cycle, 2,200-volt alternating-current type, and have special impregnated windings to protect them from moisture.

Power will be furnished by a hydroelectric plant, and feeders are run along the ground to the dredge. As alternating current is used the dredge can be operated a considerable distance from the plant. Dredges of this type have operated on a cost basis of 6½c. per cu.yd., and in one instance where records are available 418,745 cu.yd. have been dug in a period of two years.

The General Engineering Co., Salt Lake City, Utah, is retained by the Utah Consolidated Mining Co. to design and erect the 1,000-ton flotation plant which the mining company is building at Tooele, Utah.

The Henry E. Wood Ore Testing Co. has removed its assay office and chemical laboratory to 1750 Arapahoe St., Denver, Col. A necessary increase in the rate of charges is also announced but the new rates continue moderate.

TRADE CATALOGS

Wire. — The Hazard Manufacturing Co., Wilkes-Barre, Pa., has issued an interesting booklet, "Rubber-Insulated Wire," which traces the story of the manufacture of rubber-insulated wire from the winning of the crude rubber to the finished lead or cloth incased cables of insulated wire used for aërial, submarine or underground transmission lines. The Hazard company produces standard brands of insulated wire for all conceivable purposes.

Carbon Dioxide Indicators—Uehling Instrument Co., 71 Broadway, New York City, has just issued their Bulletin 111, describing their Style U CO_2 equipment. This is a new design, built to serve any number of steam boilers simultaneously, up to six. Among the notable features of the new machine are speedy action, absence of chemical solutions, greater simplicity, and an auxiliary boiler front CO_2 indicator which guides the fireman, while the CO_2 recorder installed elsewhere makes a continuous record of all changes in boiler adjustments.

Pipe Welding—The Metal & Thermit Corporation, New York, N. Y., has just issued and will distribute on request the third edition of its Thermit Pipe Welding Pamphlet No. 16. In this new edition the subject of Thermit pipe welding has been revised and brought up to date.

Drills—The Chicago Pneumatic Tool Co., 6 East 44th St., New York, announces that Bulletin 504, describing its Slogger Rock Drill, is now available, upon request, from its New York office or branches.

Melting Pots—"Metal Melting Pots" is the title of a new two-page 8½ x 11 illustrated leaflet descriptive of The Cutler-Hammer Manufacturing Co.'s melting pots, both portable and bench types. These heating pots are specially serviceable for melting lead, tin, solder, babbitt, and similar metals, and maintaining these metals at the proper temperature. The heat may be controlled by means of a rotary snap switch or an automatic control device which maintains the temperature at the desired point. The leaflet, known as Publication 826, may be had on application to the company at Milwaukee, Wis.

Crucibles—A new edition of the illustrated twenty-one-page catalog of its goods has been issued by the Ross-Tacony Crucible Co., Tacony, Pa. The pages illustrate the dimensions of the different types of general and special crucibles, retorts and accessories supplied by this company, and the pamphlet closes with two pages of hints on the proper handling of a crucible which will be appreciated by all users of this make.